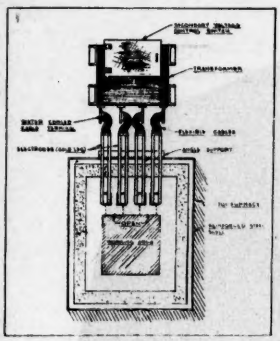
meta

the news digest magazine

Volume XXIX-No. 1 January, 1956



# HOLDEN SALT BATH FURNACES

• • Plus Values • •

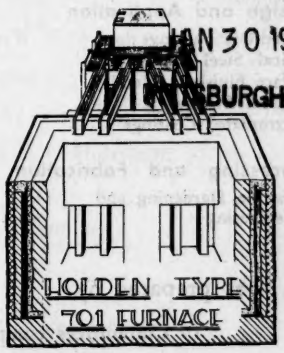
U. S. Patent No. 2,701,269

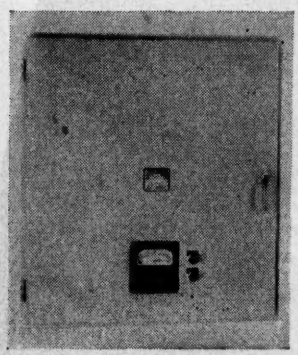
## Why not take advantage of 25% lower operating costs?

1. Furnace life—one to ten years, depending on temperatures.
2. You can replace your existing furnace unit without change of electrical equipment.
3. Less power used per 100 lbs. of work heat treated.

MELLON INSTITUTE
LIBRARY
JAN 30 1956
BURGH, PA

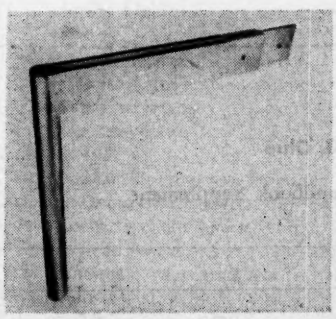
1. Entire furnace opening is working area.
2. Longer Electrode Life.
3. The inner steel assembly plus extra thick refractory means long pot life.

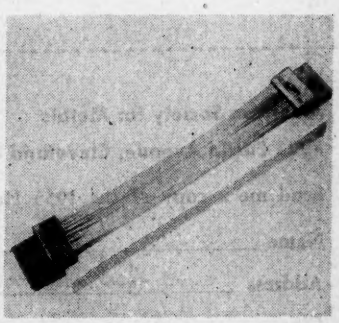


## HOLDEN MAGNETIC CONTROL PANELS

1. Built to J.I.C. Specifications for wall or floor mounting.
2. Current transformers to check 3-phase power balance, plus 110 volts for control circuits.





## HOLDEN ELECTRODES AND CABLES

Case History: An automotive parts manufacturer reports 15% more tonnage per hour using Holden Electrodes and Cables.

*Write or phone for Furnace Bulletin No. 201*

*DETROIT OFFICE: BRoadway 3-5405*

# THE A. F. HOLDEN COMPANY

THREE P.O.E. POINTS—LOS ANGELES, DETROIT and NEW HAVEN

# NOW AVAILABLE IN CLOTH-BOUND EDITION

## *. . . . the 1955 Supplement to the Metals Handbook*

### Containing detailed information on

**Metals Selection**

Sheet Steel for Formability
Material for Press Forming Dies
Gray Cast Iron
Stainless Steel for Chemical Processes
Aluminum Alloy Castings

**Design and Application**

Closed-Die Forgings
Helical Steel Springs
Surface Finish of Metals
Residual Stresses
Electroplated Coatings

**Processing and Fabrication**

Induction Hardening and Tempering
Flame Hardening
Gas Carburizing—Commercial Practice
Gas Carburizing—Use of Equilibrium Data
Control of Surface Carbon During Heat Treating
Heat Treating of Tool Steel
Manual Arc Welding of Low-Carbon Steel
Metal Cleaning Costs

**Testing and Inspection**

Creep and Creep-Rupture Tests
Radiography of Metals
Macro-Etching of Iron and Steel

as prepared by

19 Committees comprising
190 outstanding engineers

For complete details of contents, see your August 15, 1955, issue of Metal Progress . . . which contains all the articles now being offered in this cloth-bound edition. Price is $4.00 to ASM members, $6.00 to non-members.

**American Society for Metals**
**7301 Euclid Avenue, Cleveland 3, Ohio**

Send me a copy of the 1955 Handbook Supplement

Name _____

Address _____

City _____ State _____

Member of _____ ASM Chapter

☐ send bill ☐ check enclosed

# Metals Review

VOLUME XXIX, NO. 1 | January, 1956

THE NEWS DIGEST MAGAZINE

Ray T. Bayless, Publishing Director

Marjorie R. Hyslop, Editor

Betty A. Bryan, Associate Editor

A. P. Ford, Sales Manager

G. H. Loughner, Production Manager

• • •

DISTRICT SALES MANAGERS

William J. Hilty
7301 Euclid Ave., Cleveland 3, Ohio
UTah 1-0200

John B. Verrier, Jr.
James P. Hontas
55 West 42nd St., New York 36
CHickering 4-2713

C. Robert Bilbrey
53 West Jackson Blvd.
Chicago 4, Ill.
WAbash 2-7822

Donald J. Walter
20050 Livernois St.
Detroit 21, Mich.
UNiversity 4-3861

• • •

*Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: A. O. Schaefer, President; D. S. Clark, Vice-President; C. H. Lorig, Treasurer; W. H. Eisenman, Secretary; Walter Crafts, K. L. Fetters, G. E. Shubrooks, H. A. Wilhelm, Trustees; George A. Roberts, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.*

***Claims for missing numbers will not be allowed if received more than 60 days from date of issue. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".***

## CONTENTS

Appointments to A. S. M. Standing Committees ..... 4
Woodside Lecture on Research, by A. J. Herzig ..... 8
Detroit Presents Educational Series ..... 17

## IMPORTANT LECTURES

Advantages of Cermets, by J. C. Redmond ..... 5
Springs and Spring Materials, by L. M. Kulze ..... 6
Fabrication and Uses of Molybdenum, by N. L. Deuble ..... 7
Hydrogen's Effect on Steel, by C. A. Zapffe ..... 7
Machinability, by U. H. Gillett ..... 9
Pressure Bonding of Metals, by D. B. Metz ..... 10
Brittle Fracture, by C. H. Lorig ..... 11
High-Speed Drill Design and Use, by W. R. Frazer ..... 14
Powder Metallurgy Progress, by F. Lenel ..... 18
Factors Involved in Aircraft Stresses, by Doyle Brooks ..... 19
Problems in Automobile Corrosion, by J. C. Holzwarth ..... 20
Dollar Metallurgy, by J. Gurski ..... 22
Technical Aspects of T-1 Steel, by R. Manning ..... 23

## DEPARTMENTS

Meet Your Chairman ..... 12
Compliments ..... 22
Metallurgical News ..... 16
Important Meetings ..... 55
Employment Service Bureau ..... 49

## ASM REVIEW OF METAL LITERATURE

A — GENERAL METALLURGICAL ..... 25
B — RAW MATERIALS AND ORE PREPARATION ..... 26
C — NONFERROUS EXTRACTION AND REFINING ..... 26
D — FERROUS REDUCTION AND REFINING ..... 27
E — FOUNDRY ..... 28
F — PRIMARY MECHANICAL WORKING ..... 30
G — SECONDARY MECHANICAL WORKING ..... 30
H — POWDER METALLURGY ..... 31
J — HEAT TREATMENT ..... 32
K — JOINING ..... 33
L — CLEANING, COATING AND FINISHING ..... 34
M — METALLOGRAPHY, CONSTITUTION AND PRIMARY STRUCTURES ..... 37
N — TRANSFORMATIONS AND RESULTING STRUCTURES ..... 38
P — PHYSICAL PROPERTIES AND TEST METHODS ..... 40
Q — MECHANICAL PROPERTIES AND TEST METHODS; DEFORMATIONS ..... 41
R — CORROSION ..... 44
S — INSPECTION AND CONTROL ..... 46
T — APPLICATION OF METALS IN EQUIPMENT AND INDUSTRY ..... 47
V — MATERIALS ..... 48

# Appointments to A.S.M. Standing Committees

**At the meeting of the Board of Trustees of the American Society for Metals held Nov. 28, new appointments to various national committees of the Society were announced by President-Elect Schaefer and confirmed by the Board. The complete personnel of the standing committees is listed below. The new appointments are shown in italics and the numerals represent the date of expiration of the appointment. Chapter affiliations are listed rather than employment addresses.**

### Constitution and By-Laws Committee

R. E. Layton, O. A. Sutton Corp., Wichita, '56, Chairman.
W. Mack Crook, Consulting Engineer, Texas, '56.
D. W. Thompson, West Michigan, '56.
Martin E. Huether, Revere Copper and Brass, Inc., St. Louis, '57.
G. M. Snyder, Northeast Pennsylvania, '57.
*Kenneth Mackenzie, International Business Machine Corp., Southern Tier,* '58.
*William F. Eberly, Vanadium Alloys Steel Co., Philadelphia,* '58.
G. E. Shubrooks, Hamilton Watch Co., Representative of Board of Trustees, York.

### Education Committee

W. T. Lankford, U. S. Steel Corp., Pittsburgh, '56, Chairman.
R. S. Guinan, Development Engineer, Rochester, '56.
H. J. Smith, International Harvester Co., Louisville, '56.
D. J. Blickwede, Bethlehem Steel Co., Lehigh Valley, '57.
Melvin R. Meyerson, National Bureau of Standards, Washington, '57.
A. U. Seybolt, General Electric Co., Eastern New York, '57.
*Scott L. Henry, A. O. Smith Corp., Milwaukee,* '58.
*Richard Doughton, Pittsburgh,* '58.
*D. H. Runke, Canton-Massillon,* '58.

### Seminar Committee

P. A. Beck, University of Illinois, Peoria, '56, Chairman.
O. T. Marzke, Naval Research Laboratory, Washington, '56.
R. L. Cunningham, Ottawa Valley, '56.
Eric Jette, Los Alamos, '56.
R. Maddin, University of Pennsylvania, Philadelphia, '56.
Arthur S. Nowick, Yale University, New Haven, '56.
B. Averbach, Massachusetts Institute of Technology, Boston, '57.
Bruce Chalmers, Harvard University, Boston, '57.
John Fisher, General Eletcric Research Laboratory, Eastern New York, '57.
Thornton Read, Jr., Bell Telephone Laboratories, '57.
*J. S. Koehler, University of Illinois, Peoria,* '58.
*M. B. Bever, Massachusetts Institute of Technology, Boston,* '58.
*Pol Duwez, California Institute of Technology, Los Angeles,* '58.

### Vocational Education Committee

T. J. Hughel, Purdue, '56, Chairman.
M. J. Weldon, Northeastern Steel Corp., New Haven, '56.
W. F. Collins, United Carr Fastener Co., Boston, '56.
O. E. Cullen, Toledo, '57.
Albert R. Fairchild, Jr., Carolinas, '57.
W. E. Frank, Peoria, '57.
Jacob Gantner, National Cash Register Co., Dayton, '57.
*E. L. Bartholomew, Jr., University of Connecticut, Hartford,* '58.
*Elmer Gammeter, Babcock & Wilcox Co., Milwaukee,* '58.
*Joseph Gurski, Ford Motor Co., Detroit,* '58.
*C. A. Higgerson, New York State University Institute, Rome,* '58.
G. A. Fisher, Jr., International Nickel Co., St. Louis, Chairman, Advisory Committee on Metallurgical Education, '56.
Karl Fetters, Representative of Board of Trustees, Mahoning Valley.

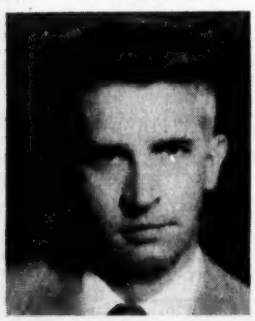
### Advisory Committee on Metallurgical Education

G. A. Fisher, Jr., International Nickel Co., St. Louis, '56, Chairman.
H. E. Flanders, University of Utah, Utah, '56.
E. E. Stansbury, University of Tennessee, Oak Ridge, '56.
Morris Cohen, Massachusetts Institute of Technology, Boston, '57.
Robert F. Hehemann, Case Institute of Technology, Cleveland, '57.
J. W. Ludewig, Carnegie Institute of Technology, Pittsburgh, '57.
J. U. MacEwan, McGill University, Montreal, '57.
*Kenneth E. Rose, University of Kansas, Kansas City,* '58.
*Robert Sweet, Michigan State College, West Michigan,* '58.
*A. W. Grosvenor, Drexel Institute of Technology, Philadelphia,* '58.
*C. W. Mason, Cornell University* '58.
H. A. Wilhelm, Representative of Board of Trustees, Des Moines.

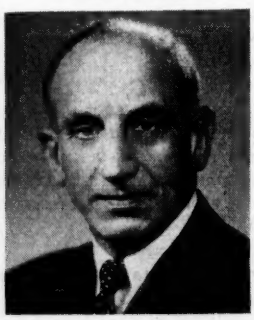
### Handbook Committee

N. E. Promisel, Navy Bureau of Aeronautics, Washington, '56, Chairman.
F. R. Anderson, Gardner Denver Co., Rocky Mountain, '56.
W. L. Badger, General Electric Co., Boston, '56.
M. L. Frey, Allis Chalmers Manufacturing Co., Milwaukee, '57.
S. R. Callaway, General Motors Corp., Chicago, '57.
T. A. Frischman, Eaton Manufacturing Co., Cleveland, '57.
Ralph Leiter, Budd Co., Philadelphia, '57.
George Perkins, Reynolds Metals Co., Louisville, '57.
C. W. Briggs, Steel Founders Society of America, Cleveland, '57.
*Arthur R. Oakley, Steel & Machine Tool Sales Co., Texas,* '58.
*G. F. Kappelt, Buffalo,* '58.
*F. T. McGuire, Deere & Co., Tri-City,* '58.
*J. J. Repko, National Advisory Committee for Aeronautics, Cleveland,* '58.

*T. J. Hughel*

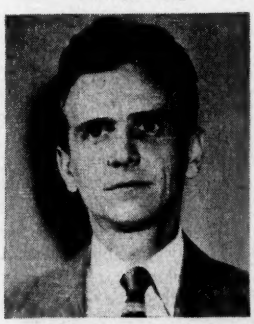


*C. H. Lorig*



*N. E. Promisel*

*D. J. Carney*



MELLON INSTITUTE
LIBRARY
JAN 30 1956
PITTSBURGH, PA.

## Appointments to A.S.M. Standing Committee

*(continued)*

### Publications Committee

D. J. Carney, Chicago, '56, Chairman.
H. S. Avery, American Brake Shoe Co., New York, '56.
Peter Payson, Crucible Steel Co., Pittsburgh, '56.
James Wyatt, Horizons Inc., Cleveland, '56.
W. D. Manly, Oak Ridge National Laboratory, Oak Ridge, '56.
R. D. Chapman, Chrysler Corp., Detroit, '56.
G. W. Birdsall, Reynolds Metals Co., Louisville, '57.
Glenn A. Fritzlen, Purdue, '57.
J. F. Libsch, Lehigh University, Lehigh Valley, '57.
R. I. Jaffee, Battelle Memorial Institute, Columbus, '57.
*George Enzian, Jones & Laughlin Steel Corp., Pittsburgh,* '58.
*H. Y. Hunsicker, Aluminum Co. of America, Cleveland,* '58.
*William A. Reich, General Electric Co., Detroit,* '58.
*Daniel J. Girardi, Timken Roller Bearing Co., Canton-Massillon,* '58.
*Paul G. Nelson, Budd Co., Philadelphia,* '58.

### Finance Committee

C. H. Lorig, Battelle Memorial Institute, '56, Columbus, Chairman.
Clyde Williams, Battelle Memorial Institute, Columbus, '56.
A. B. Kinzel, Union Carbide & Carbon Research Laboratory, Inc., New York, '56.
A. A. Hess, American Society for Metals, Cleveland, '56.
F. R. Morrall, Kaiser Aluminum & Chemical Corp., Inland Empire, '56.
Erith T. Clayton, Tainton Co., Baltimore, '57.
Bob Daykin, Ladish Co., Milwaukee, '57.
Zay Jeffries, General Electric Co., Cleveland, '57.
*K. R. Van Horn, Aluminum Co. of America, Pittsburgh,* '58.

### Metal Progress Advisory Committee

Frank G. Foote, Argonne National Laboratory, Chicago, '56, Chairman.
H. J. Nichols, Physical Metallurgy Research Laboratories, Ottawa Valley, '57.
Don Rosenblatt, American Foundry & Machine Co., Utah, '57.
Leo P. Tarasov, Norton Co., Worcester, '57.
*G. M. Young, Aluminum Co. of Canada, Ltd., Montreal,* '58.
*John W. Sweet, Puget Sound,* '58.
D. S. Clark, Representative of Board of Trustees, Los Angeles.

## *Details Advantages of Cermets*

*John C. Redmond, Kennametal Inc., Presented a Talk Entitled "Cermets" at a Meeting of the Northwestern Pennsylvania Chapter. Shown are, from left: G. E. Mohnkern, secretary-treasurer; Gordon D. Kimpel, vice-chairman; Mr. Redmond; and Robert W. Thomas, Jr., program chairman*

Speaker: John C. Redmond

*Kennametal Inc.*

Forty-eight members and guests managed to make their way through howling winds, snow and slippery roads to get to **Northwestern Pennsylvania's** meeting at which John C. Redmond, vice-president, research and development, Kennametal Inc., spoke on "Cermets".

While indicating that the word "cermet" has grown until it includes most material that is not organic or totally metal, Mr. Redmond centered his talk around the various grades of titanium carbide combinations produced by his company for high-temperature uses.

Slides showing physical properties at elevated temperatures gave a comparison of several grades of this material and indicated the effect of alloying the nickel bonding metal with molybdenum and aluminum.

In most cases. super alloys are used as a reference value and as the temperature reaches 1600° F. a decided advantage is evidenced by the TiC material. If the temperature is above 2000° F. and application calls for fairly high stress, here is a material that certainly deserves consideration.—**Reported by G. E. Mohnkern for N.W. Pennsylvania.**

## Outlines Techniques for Metal Cleaning and the Preparation for Painting

Speaker: Samuel Spring

*Pennsylvania Salt Mfg. Co.*

Samuel Spring, technical division, Pennsylvania Salt Manufacturing Co., addressed the **Northeast Pennsylvania Chapter** on "Metal Cleaning and Preparation for Painting".

Dr. Spring explained and illustrated the mechanism by which chemical detergents remove oil films from metal surfaces by "gathering" them into easily detached globules. He stated that light oils and smooth surfaces make cleaning easier.

Because most of the soils in industry are acid in character, alkali materials are needed for neutralization of the surface before cleaning can take place. The alkalis intermediate in alkalinity and buffering capacity, such as sodium silicate, happen to make the best cleaners, indicating that alkalinity, at least, is not the most important factor.

The speaker described the cleaning and phosphatizing cycle used widely in the automotive and home appliance industries. The cycle consists of (1) cleaning by alkali spray or soak, emulsion spray, vapor degreasing, acid rinse or mechanical methods, (2) a rinse, (3) phosphatizing using spray or dip, (4) another rinse, and (5) the sealing or chromic acid rinse.

Dr. Spring stated that spray cleaning should be limited to those materials which do not create excessive foam. Because vapor degreasers are solvents, their residues must be removed from the surface by an alkaline wash for electroplating but are usually tolerable in phosphatizing. Where oxides are present on the metal surface, acid cleaning methods must be used.

The phosphate coating not only improves the adherence of the subsequent paint film but also aids in inhibiting the spread of corrosion at breaks in the paint. Phosphate coatings which possess excessive porosity reduce the glossy appearance of the paint film. An activating treatment, which consists of the application of a colloidal titanium compound, results in a finer crystalline structure of the phosphate coating and less pore space. This condition results in the need for less paint, provides improved corrosion resistance, and lighter phosphate coating weights.

Iron and zinc phosphate coatings differ in that the former is cheaper to apply, but it also is more sensitive to the prior history of the steel surface so that it is not amenable to as many steels as the zinc phosphate coating.—**Reported by A. J. Babecki for N.E. Pennsylvania.**

## *Discusses Springs and Spring Materials*

*L. M. Kulze (Left), of William D. Gibson Co., Explains Spring Properties of Three Different Metals to N. J. Finsterwalder, Vice-Chairman, at a Meeting Held Recently by the Rochester Chapter. (Photo by J. H. Brown, Jr.)*

Speaker: L. M. Kulze
*The William D. Gibson Co.*

L. M. Kulze, chief engineer, The William D. Gibson Co., discussed "Springs and Spring Materials" at a meeting of the **Rochester Chapter.**

Despite the fact that most mechanical assemblies depend upon springs of one type or another, Mr. Kulze pointed out that these important units often lose their identity in the finished product. Hence, enough emphasis cannot be given to proper design and selection of material.

Because precision mechanical springs are in most common usage in the spring family, Mr. Kulze presented detailed characteristics of the carbon, alloy and nonferrous group and stated that the functions of all are governed by modulus—in this case meaning "the measure of the stiffness of the material" (in tension or its elasticity).

Informative slides and the accompanying explanations highlighted the fact that the spring business is essentially a jobbing industry and that proper knowledge of physical properties and complete specifications will enable the supplier to provide a suitable product at a moderate cost.

The selection of the correct type of ends to use on a compression spring is important. Some applications permit squared ends, not ground, which eliminate the tangling problem common with open-end springs. Otherwise, the ends of the springs should be squared and ground.

In the order of usage and cost, each grade of spring material was covered—0.60 to 0.70% carbon wire, hard drawn to definite tensile strengths, SAE 1065, pretempered before forming, SAE 6150, music wire, 18-8 Type-302 stainless, phosphor bronze, and beryllium copper.

Due to the critical functions of valve springs made from high-quality carbon, chromium-vanadium and chromium-silicon grades of steel, special attention must be paid to fine surface finish, freedom from decarburization and rigid control of heat treatment. These are the factors which result in the consistent high endurance limits required.

While other detailed and interesting phases of this subject were clearly discussed, another often overlooked problem was emphasized. That is, the fact that only the physical values of different materials at room temperatures are considered, whereas, in actual service, the springs are used at temperatures far from those at which laboratory tests were run. Special equipment and exhaustive tests have been devised to determine the effects of temperatures from —75° to 700° F. on the modulus, endurance limit and load loss in springs made of the various types of wire. Based on the data accumulated from these tests, it is now possible to design springs which will perform as required at temperatures considerably above or below room temperature.—**Reported by Frank J. Gehrlein for Rochester Chapter.**

## Rochester Chapter Sets Up Three-Year Course On Metals Technology

Frank E. Trevett, chairman of the **Rochester Chapter's** educational committee, has announced completion of details for the presentation of a three-year educational program. The course, which started on Nov. 2, will continue for 17 weeks and will be presented this year by past-chairman John J. Hoffer, metallurgist at the Hawk-Eye Works, Eastman Kodak Co.

This series is the result of considerable planning for the past year by Mr. Trevett and his committee to set up a long-range program prepared especially for industries in the Rochester area. Designed to provide a practical background of metallurgy, the course will be of value to anyone connected with processing, specifying, designing or inspecting metals.

The first year's session, entitled "The Nature of Metals", will incorporate the use of the A. S. M. book of the same name, together with slides and films which will be furnished by the national office of A. S. M. The second and third years will cover "Applied Metallurgy", Parts I and II. Classes will be held on Wednesday nights at the University of Rochester and certificates will be awarded for each year's course.—**Reported by Frank J. Gehrlein for Rochester Chapter.**

---

## Discusses Heat Treating in Controlled Atmospheres at Meeting of Peoria Chapter

Speaker: N. K. Koebel
*Lindberg Engineering Co.*

N. K. Koebel, manager, Heat Treat Furnace Division, Lindberg Engineering Co., spoke before a meeting of the **Peoria Chapter** on "Heat Treating in Controlled Atmospheres."

Mr. Koebel presented a series of slides which outlined the theories of atmosphere control. He emphasized the endothermic generator since atmospheres for hardening, carburizing and carbonitriding are usually obtained from this type generator.

The speaker also discussed some of the new equipment for automatic atmosphere control of both the generator and the furnace. He stated that most of the control is accomplished by instruments that regulate the dew point of the atmosphere.

Some of the newest equipment for furnaces are vertical radiant tubes in furnaces and core-therm elements for pit-type carburizers. Immersion heaters, which give the heat treater the advantages of both carbonitriding and marquenching, are now standard equipment for most carbonitriding furnaces.—**Reported by James M. Warfield for Peoria.**

## Fabrication and Uses of Molybdenum and Its Alloys Explained at Rocky Mt.

Speaker: N. L. Deuble

*Climax Molybdenum Co.*

Members of the **Rocky Mountain Chapter** recently heard Norman L. Deuble, manager of the metallurgical development division, Climax Molybdenum Co., present a talk on "Molybdenum in Metallurgy". The talk covered the manufacture, fabrication and applications of molybdenum and molybdenum-base alloys.

Mr. Deuble emphasized some of the advantages of arc-cast molybdenum over the powder metallurgy product, such as the increased sizes obtainable and better mechanical properties in larger size ranges. He illustrated and described an expendable-electrode arc furnace with water-cooled copper hearth used to produce cast molybdenum. The equipment includes a facility for continuous build-up of the electrode from powder to permit melting of large masses. The largest ingot produced to date has been 9 in. in diam. by 48 in. long.

The speaker described some of the difficulties of fabricating the ingots and how troubles were eliminated. The elevated temperature strength of molybdenum and its susceptibility to oxidation have presented some unique problems. Special forging dies and heating cycles are required to control structure and hardness for optimum properties. Frequent reheating is necessary between rolling stages. The extrusion of molybdenum, using a glass lubricant, has recently been demonstrated as feasible, and the process is now used exclusively to break down ingots to billets.

Since molybdenum exhibits no allotropic transformation, improvements of mechanical properties can best be accomplished by cold work and with suitable alloy additions. Mr. Deuble pointed out that significant improvements have been effected at Climax by the use of small additions of elements such as vanadium, columbium, titanium and zirconium. In addition to hardening by solid solution effect, some of these additions elevate the recrystallization temperature and thus extend the temperature range of high strength and utility. High-temperature oxidation resistance has been obtained by means of sprayed coatings of aluminum and chromium-silicon mixtures. Intended applications under consideration include gas turbine blades, rocket nozzles, piercing points for seamless tubing, and electrodes for glass processing.

The speaker also described the mechanical and thermal testing procedures used at Climax to evaluate molybdenum and discussed the machinability of this material.—**Reported by F. C. Perkins for Rocky Mountain Chapter.**

## *Reports on Hydrogen's Effect on Steel*

*Carl A. Zapffe (Right), Consulting Metallurgist, Who Presented a Talk on "Hydrogen in Steel" at a Meeting in Baltimore, Is Shown With J. J. Link, Bethlehem Steel Co., Who Was Technical Chairman of the Meeting*

Speaker: Carl A. Zapffe

*Consulting Metallurgist*

Members of the **Baltimore Chapter** heard a talk on "Hydrogen in Steel" presented by Carl A. Zapffe, consulting metallurgist.

Shortly before World War II, German investigators discovered that hydrogen gas dissolved in heavy steel forgings was the principal cause of the internal defect variously called a "flake" or "shatter crack", and also that this gas could cause certain types of cracking in steel welds, and even chipping in vitreous enamel coatings applied to steel.

In the following decade or two, a tremendous amount of work exploring the effects of hydrogen in many metals was done. Points which were hotly debated at the time of the earlier discoveries have by now become greatly clarified.

Mr. Zapffe, who is currently preparing a review of the entire hydrogen story for a book on fracture, presented a summary of the whole technology, from gas reactions with liquid metals, down through high-temperature reactions in the solid state, and finally to those outstanding pressure-type defects which characterize most ferrous gas-metal systems at ordinary temperatures. The subjects included solidification porosity of both pinhole and shrinkage type, decarburization and hydrogen attack, boiler and caustic embrittlement, flakes and white spots in forgings, fisheyes and underbead cracking in welds, and embrittlement from various electroplating and pickling operations, and recovery.

A three-dimensional model for the Fe-H system was shown and the use of the third or pressure variable was emphasized as a requirement for gas-metal discussions. Also, a further variable, surface tension, was shown to be necessary for understanding reactions in finely divided systems such as powders or colloids, and probably necessary for defining the actual state of the gas as distributed throughout the imperfection structure of the solid metal.

More than 50 slides were used to illustrate these points. An interesting question and answer period was held at the conclusion of Mr. Zapffe's talk.—**Reported by J. S. White for Baltimore Chapter.**

## *Talks at Pittsburgh*

*National President A. O. Schaefer Is Shown as He Delivered His Talk on "Application of Emergency Metallurgy to Peacetime Work" at the National Officers Night Meeting of the Pittsburgh Chapter. (Reported by J. J. Heger for the Pittsburgh Chapter)*

## *Gives Woodside Lecture on Research*

*Alvin J. Herzig (Center), Guest Speaker at a Meeting of the Detroit Chapter, Is Shown Receiving the Woodside Memorial Lecture Certificate From A. D. Wagner (Right), Chairman. Mr. Herzig spoke on "William Park Woodside in Research". Looking on is Technical Chairman W. E. Jominy*

Speaker: Alvin J. Herzig

*Climax Molybdenum Co. of Michigan*

The thirteenth annual William Park Woodside Lecture was presented to the **Detroit Chapter** by Alvin J. Herzig, president, Climax Molybdenum Co. of Michigan. Mr. Herzig's subject was "William Park Woodside in Research". Mr. Woodside is a founder member and a past president A.S.M.

Taking advantage of his intimate association with Mr. Woodside, founder of Climax's research laboratory, Mr. Herzig wove the story of the development of the technical foundation for molybdenum as an alloying element in steel and cast iron with the story of Mr. Woodside's philosophy of laboratory operations. He gave the first public account of the development of the arc-casting process for melting ingots of molybdenum and molybdenum-base alloys, describing the general characteristics and some potential applications of this new material.

With regard to Mr. Woodside's philosophy of investigation, Mr. Herzig referred to the basic concept that the "skilled worker and the professional worker should be of mutual inspiration and assistance". As examples of the personalized approach to research, Mr. Herzig emphasized the importance to Mr. Woodside of the men associated with a metallurgical development. To him, the man's name and the composition or process were synonymous. Mr. Herzig's lecture contained an amazing number of these name associations.

In reviewing the efforts of the laboratory, Mr. Herzig gave an interesting account of the role of molybdenum in the metallurgy of steel and cast iron. He summarized the work of the Climax laboratory and of other laboratories by stating that it was established that the case for molybdenum in the alloy steel field rested in the following primary attributes:

1. It is an effective contributor to hardenability.
2. It does not induce susceptibility to temper brittleness and within limits neutralizes the susceptibility to embrittlement induced by other elements.
3. It contributes to elevated temperature strength and hardness. It is the most effective single addition to attain creep resistance.
4. It establishes the capacity for the attainment of red hardness.
5. It permits the employment of high hardenability compositions with a minimum sacrifice in machinability.
6. Except when present in amounts exceeding about 4%, it does not require significant modification of the established practice for producing, heat treating and fabricating the steels containing it. Molybdenum containing steel scrap can be recycled without significant loss of molybdenum.

In the field of cast iron, Mr. Herzig credited V. A. Crosby with pointing out the importance of control of graphite form and dispersion to the study of the influence of an alloying element and the effectiveness of Mr. Crosby's use of the late silicon addition to achieve uniform graphite distribution. With such control available, it was possible to apply the principles learned in steel research to modify the properties of cast iron by alloying. Earlier work had shown that molybdenum neither stabilized nor promoted graphitization of the carbide phase, thus making it a most useful alloying element in modifying the properties of cast iron.

The development of the process for making massive sections of ductile molybdenum by vacuum arc-casting was illustrated by an interesting series of slides. The slow and painful progression from little buttons of brittle metal to massive ingots that can be extruded and rolled with facility was a fascinating story. Mr. Herzig reminded his audience that the list of elements which have achieved the role of alloy-base metals in all metallurgical history is not a particularly long one. The metals of antiquity would be copper, iron, tin, lead and a few of the noble metals. The modern metals of the list would be nickel, zinc, aluminum, cobalt and magnesium. Intensive laboratory work at the present time on new alloy-base metals centers around titanium, molybdenum, chromium, zirconium and columbium. One was convinced, after listening to Mr. Herzig's presentation, that molybdenum-base alloys are here to stay.—**Reported by D. V. Doane for Detroit.**

## Rockford Features Talk On Material Metallurgy

Speaker: O. W. McMullan

*Bower Roller Bearing Co.*

O. W. McMullan, chief metallurgist, Bower Roller Bearing Co., spoke on "Material Metallurgy and Machining" at a meeting held by the **Rockford Chapter.**

Mr. McMullan discussed the relationship of hardness and structure to machinabiltiy. Machinability was defined as the removal of the most material in the least time with the least irritation to the machinist.

A point emphasized was that a combination of weakness and brittleness was the most desired in a metal structure for optimum machining. In a steel, these factors are somewhat incompatible; hence, a compromise or blending of these factors must be made.

As to the relationship between hardness and structure, the speaker thought that hardness could be considered as the coarse adjustment and metallographic structure as the fine adjustment. Concerning the fine aspects of structure, it was pointed out that the distribution of microconstituents was all important. Cited as good examples of good machining structures were "blocky" pearlite and the presence of embrittlement in the grain boundaries. It was pointed out that it was not always advisable to have the best machining structures because other processing operations or properties of the end product might be adversely affected, even in parts subsequently heat treated. The range of Brinell 140-200 was given as the usual optimum range for ferrous materials. Below Brinell 140 most ferrous materials act "gummy" and above Brinell 200 the material is so hard that tool life is lowered.—**Reported by E. C. Wallace for Rockford Chapter.**

## Machinability Is Subject Of Talk in West Michigan

Speaker: U. H. Gillett
*Barber-Colman Co.*

At a meeting of the **West Michigan Chapter,** Ural H. Gillett, metallurgical consultant, small tool division, Barber-Colman Co., presented a discussion on "Metallurgical Aspects of Machinability".

The ideal material from a machinability standpoint is both brittle and weak. Steel is not an ideal material as far as machinability goes. The physical properties of steel depend largely upon its microstructure. The metallurgist can, through proper selection of microstructure, help the machinist perform his operations with greater ease, thus realizing the goal of lower costs and higher quality levels.

Mr. Gillett pointed out that a certain microstructure which might be best for one type of machining operation might not prove to be the best for another type. A compromise microstructure is sometimes necessary where drastically different types of machining operations must be performed on a part. An alternate solution would be to choose a microstructure which would favor more critical machining operations or to change microstruture between operations by heat treatment.

The resulfurized and leaded steels are called free-machining steels. The sulfur and lead additives serve as lubricants on the tool, lowering the coefficient of friction, thereby reducing the amount of heat generated and the amount of power required to force the tool through the steel. It is also thought that these additives help break up the chips. The size of inclusion in the steel is apparently of importance.

Many parts must be machined after heat treating to a tempered martensite. In these cases tool life and production rate must be sacrificed. It was pointed out that the machinability of tempered martensite decreases sharply with higher hardness levels.

Mr. Gillett illustrated his lecture with slides showing various microstructures and charts giving machining information.—**Reported by Richard F. Haskins for West Michigan.**

## Talks on Steel Hardening

Speaker: A. C. Mueller
*Western Rock Bit. Co.*

At a meeting held recently by the **Phoenix Area Chapter,** Charles A. Mueller of Western Rock Bit Co. presented a talk entitled "Steel Hardening With Controlled Atmospheres". An interesting question and answer period followed his discussion.—**Reported by D. A. Rich for Phoenix Area Chapter.**

## *Talks on Guided Missiles at Worcester*

*Leaders at a Meeting Held by the Worcester Chapter Included, From Left: Herbert D. Berry, Thomas Smith Co., Chairman; William R. Eaton, Manager of Test and Quality Control, General Electric Co., Who Spoke on a "Decade of Guided Missile Progress"; and Arthur L. Stowe, Massachusetts Steel Treating Corp., Technical Chairman. (Photograph by C. W. Russell)*

Speaker: W. R. Eaton
*General Electric Co.*

William R. Eaton, manager of test and quality control for General Electric Co.'s guided missile operation, addressed members of the **Worcester Chapter** recently on "A Decade of Guided Missile Progress".

Mr. Eaton described the make-up and workings of a guided missile, outlining its development from the days of the German V-1, or so-called "Buzz Bomb."

He showed slides of the different types of American guided missiles and explained their respective capacities. Missiles were shown being launched and their flight detail dwelt upon. The operation of ship-to-shore missiles was described.

Mr. Eaton presented a movie on the early German rockets which were used against Great Britain. He acquainted his audience with many of the problems in their development, leaving the impression that many advances will be made in their use and effectiveness.—**Reported by C. Weston Russell for Worcester.**

## *Panel Discusses Welding Problems*

*Panel Members Who Answered Questions on "Industrial Welding Problems" at a Meeting in Jacksonville Included, From Left: C. Clanton; Sam Duval, Air Reduction Sales Co.; George Kelly, Linde Air Products Co.; Billy Weeks, Georgia Supply Co., Representing Westinghouse Electric Co.; Chet Shira, Lincoln Electric Co.; and Bernie Boisvert, Naval Air Station. Joe F. Campbell (right), chairman, presided over the meeting*

Members of the **Jacksonville Chapter** heard a panel of qualified welding engineers discuss "Industrial Welding Problems" recently.

The panel, which included Chet Shira, Charles Clanton, Sam Duval, George Kelly, Bernard Boisvert, F. O. Powell and Billy Weeks, covered Heliarc, thermit, sigma, Westing arc, submerged arc and various other types of welding. Chairman Joe Campbell, Grant Manufacturing Co., presided over the meeting.

Questions from the audience which were answered by the panel covered the use of propane gas versus acetylene for use in flame cutting, problems in welding high-alloy tools and dies, present use of Thermite in the field, reduction of splatter on low and mild steel, and powdered iron coated rods versus hand submerged-arc welding.—**Reported by Stephen Bowes for Jacksonville Chapter.**

## *Speaks on Pressure Bonding of Metals*

*"Pressure Bonding of Metals" Was the Topic of a Talk Given by D. Boyd Metz, Sylvania Electric Products Inc., at a Meeting of Savannah River. Shown are, second to left: E. A. Orr, secretary; W. L. Worth, technical program chairman; C. C. McBride, chapter chairman; and Mr. Metz*

Speaker: D. Boyd Metz
*Sylvania Electric Products Inc.*

"Pressure Bonding of Metals", one of the newer fields of metallurgy, was the main topic presented before members of the **Savannah River Chapter** at its first meeting of the new season, attended by about 50 members and guests. D. Boyd Metz, plant manager, Sylvania Electric Products Inc., was the speaker.

Mr. Metz explained how basic concepts of pressure bonding were developed at Sylvania for use in the fabrication of components for electronic tubes in temperature-sensitive electrical instruments.

Experience and knowledge gained during these developments were recently applied at Sylvania's Hicksville plant in the fabrication of atomic reactor fuel elements. Mr. Metz stated that many parallels between fuel element bonding and electronic tube component bonding had furnished basic techniques in the new development. Stability of metals under electronic bombardment in tubes can be compared to neutron bombardment in reactors.

Bonding of metals at temperatures below their melting point is dependent upon temperature, applied pressure and pressing time. In addition, extreme cleanliness of the surfaces to be bonded is required.

In general, reactor fuel element bonding is done in vacuo, since the cladding metal is usually aluminum. Exposure to air of aluminum components, at the temperatures used for pressure bonding, would cause rapid oxidation of mating surfaces and resultant poor bonding. Because maximum heat transfer characteristics are required in fuel elements, formation of intermetallic compounds during bonding is limited as much as possible. Formation of such bond layers causes a rapid decrease in heat transfer rate, with increasing bond thickness and number of intermetallic compounds. Generally, fuel cores are plated with a low cross section metal, which will not form intermetallics with the aluminum jacket.

The speaker briefly compared pressure bonding with other cladding techniques such as roll cladding, extrusion cladding and casting. In none of the latter techniques can all variables of time, temperature and pressure be completely controlled as they can in pressure bonding.

Additional advantages of pressure bonding result from the multitude of shapes that may be formed with changes in die design. Also, powdered metals may be used where high melting temperature or forming difficulties may cause prohibitive expense.—**Reported by D. T. Kauer for Savannah River.**

## Minnesota Hears Story of The Romance of Metals

Speaker: H. K. Ihrig
*Allis Chalmers Co.*

H. K. Ihrig, vice-president in charge of research division, Allis Chalmers Co., gave a talk titled "Romance of Metals". at a meeting of the **Minnesota Chapter.**

Dr. Ihrig told about many romantic phases of the history and discovery of metals. He gave as an example the spheroidizing of cast iron, which increased its mechanical strength and ductility many times.

In his discussion, he touched upon the magnetic qualities of stainless steel. The majority of people have the idea that 18-8 stainless is nonmagnetic but such is sometimes not the case.

Samples which were passed around the audience included stainless tubing severely cold worked and then annealed at one end: one end was magnetic and the other end nonmagnetic. A bar made from copper, manganese and aluminum exhibited as good magnetic qualities as one made from a nickel or cobalt alloy.

Another interesting phase of Dr. Ihrig's presentation was his patented process for hard casing steel with silicon. This process was brought out clearly by the use of slides. Pictures showed material which was so resistant to acid that an etching process ate away the entire core and left only the casing.

In addition, some of the interesting history and anecdotes on the relatively new metals, aluminum, magnesium and titanium, were explained briefly by the speaker.—**Reported by Henry Davis for Minnesota Chapter.**

## *At Mahoning's National Officers Night*

*At the Mahoning Valley Chapter's National Officers Night Meeting, A. O. Schaefer, President A. S. M., Gave an Informative Talk on "Applications of Emergency Metallurgy to Peacetime Work". Shown are, from left: P. T. Kelley, Chapter chairman; Mr. Schaefer; and K. L. Fetters, A.S.M. Trustee*

# *Panel Covers High-Temperature Materials*

*A Panel Composed of Los Alamos Scientists Discussed "High-Temperature Materials and Problems" at a Meeting of the Los Alamos Chapter. Panelists were, from left: M. G. Bowman, thermodynamicist; S. D. Stoddard, ceramicist; R. B. Gibney, physicist; J. M. Taub, metalurgist and panel moderator; W. W. Martin, metallurgist; and D. P. MacMillan, physicist. (Photograph by Clayton O. Matthews for Los Alamos Chapter)*

Panelists James M. Taub, metallurgist, Melvin G. Bowman, thermodynamicist, Robert B. Gibney, physicist, Donald P. MacMillan, physicist, William W. Martin, metallurgist, and Stephen D. Stoddard, ceramicist, all of the research staff of the Los Alamos Scientific Laboratory, each presented a different aspect on "High-Temperature Materials and Problems" at a panel meeting held recently by the **Los Alamos Chapter.**

The growing requirements and applications for materials to be used in high-temperature environments were discussed first, followed by an evaluation of what materials appear to be most appropriate and the problems involved in their fabrication. The thermodynamic aspects were considered from the viewpoint of determining the types of reactions which might be expected to occur in various high-temperature environments from calculation of free energy changes. It was brought out that undesirable compounding or alloying by the surrounding media would, of course, limit the number of materials which could be used successfully under a given set of conditions.

Problems of fabricating into useful shapes the higher melting point metals, such as molybdenum, tantalum and tungsten, were discussed, as were those pertaining to ceramic materials—the nitrides, oxides and carbides. Also covered were some representative properties of these materials as reported in the literature. Wide variations in reported values for physical and mechanical properties at higher temperatures were very notable and it was generally agreed that there is need for a great deal of careful experimental effort in this field.—**Reported by Daniel J. Murphy for the Los Alamos Chapter.**

## *Technical Papers Invited for A.S.M. Transactions*

**The Publications Committee of the A.S.M. will now receive technical papers for consideration for publication in the 1957 *Transactions* and possible presentation before a national meeting of the Society. A cordial invitation is extended to all members and nonmembers of the A.S.M. to submit technical papers to the Society.**

**Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 38th National Metal Congress and Exposition to be held in Cleveland Oct. 8-12, 1956. All papers that are accepted will be preprinted. Manuscripts should be received at A.S.M. headquarters office not later than April 2, 1956.**

**Acceptance of a paper for publication does not necessarily infer that it will be presented at the annual convention. The selection of approved papers for the convention program will be made early in June.**

**Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.**

**Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.**

## Lorig Speaks on Brittle Fracture at Birmingham

Speaker: C. H. Lorig

***Battelle Memorial Institute***

Clarence H. Lorig, Battelle Memorial Institute, and national treasurer A.S.M. spoke on "Brittle Fracture of Steel" at a meeting held by the **Birmingham Chapter.**

The program for the evening, in addition to Dr. Lorig's talk, included acknowledgment of the chapter's sustaining members and constituted the last lecture in the chapter's education course.

Dr. Lorig spoke of catastrophic failure in welded structures such as liberty ships, pressure vessels, bridges and the "big inch". This type of failure was defined as a fracture out of all proportion to the stress involved. These failures were attributed to three factors occurring simultaneously—high stress, the presence of a notch to concentrate stress and a steel of low notch toughness.

A test named the "S.O.D. test" has been devised to measure average stress magnitude in a mild steel structure. In this type of steel, the stress required for brittle failure, when the other factors are favorable, is within the range of 10,000 to 15,000 psi.

The measurement of notch sensitivity in a material is extremely complicated since the material is usually subjected to tri-axial stress where thickness, defects and width must all be considered. The notch toughness is normally evaluated by notch bar impact tests at various temperatures to indicate the transition temperature (shift to brittle fracture) of the metal.

Factors influencing the temperature at which brittle fracture occurs in steel are the composition, grain size of the steel and the finish rolling temperature.—**Reported by O. C. Bertossa for Birmingham Chapter.**

# Meet Your Chapter Chairman

*L. C. Kimpal*

*E. C. Wallace*

*H. D. Berry*

### WORCESTER

HERBERT D. BERRY, vice-president and assistant manager, Thomas Smith Co., was born in Westboro, Mass., where he attended primary and high schools. After graduation from Worcester Polytechnical Institute, Herb did estimating and sales work.

Herb is married and has two daughters. He is a member of the Pressed Metal Institute, the Worcester Engineering Society and the American Ordnance Association. He has served the Worcester Chapter on the educational and executive committees. Photography and golf are Herb's chief pastimes.

### ROCKFORD

EDGAR C. WALLACE was born in Petosky, Mich. He attended the public schools and graduated from Michigan College of Mining and Technology with a B.S. degree in 1936. His first job out of school was as a product metallurgist for the American Steel & Wire Co. Ed is presently head of the metallurgy department at Barber-Colman Co., where he has been employed since 1946.

Married and the father of two children, Ed has been active in many capacities in his chapter A.S.M. He likes boating and fishing. During World War II he was an officer in the Corps of Engineers, spending about two years helping to build the Alaska highway.

### ROCHESTER

LEON C. KIMPAL, industrial gas engineer and golfer and a life-long Rochestarian, was graduated from what is now the Rochester Institute of Technology in 1910. In 1912, after a period of employment manufacturing telephones, he joined the Rochester Gas and Electric Corp. and has been with that company ever since.

"Kimp" served a two-year hitch in the Navy as a chief boatswains mate during World War I. For ten years after his release from active duty, he took an active part in the local naval militia.

Mr. Kimpal is a past chairman of the American Foundrymens Society and a long-time member of the American Gas Association. Three children and nine grandchildren have added richness to Mr. and Mrs. Kimpal's busy lives.

### CINCINNATI

FRED WESTERMANN, assistant professor of metallurgical engineering at the University of Cincinnati, received his degree in chemical engineering from U.C. in 1944 and his M.S. degree in 1947. He has been teaching since 1948 and is presently working on his Ph.D in metallurgy.

Mr. Westermann is married and has three children, ages one to five. He is a member of several social and technical organizations, and has served on many committees for his chapter A.S.M. His industrial experience includes development work on synthetic rubber as well as assignments in various metallurgical laboratories during his co-operative education at University of Cincinnati. He served in the Army from 1944 to 1946, including overseas service in India. Aside from metallurgy, Fred's primary hobby is model railroading.

### PITTSBURGH

THOMAS I. MCCLINTOCK was born in Pittsburgh, where he attended the public schools. He graduated in 1940 from Carnegie Institute of Technology with a B.S. degree in metallurgical engineering. While in college, Mr. McClintock joined A.S.M. as a student member and has been a member since that time. He has also served on the executive committee and as vice-chairman of the Pittsburgh Chapter.

Tom joined Aluminum Co. of America's metallurgical division after graduation and spent 10 years as a plant metallurgist in the New Kensington works. Since 1950 he has acted in an administrative capacity in the quality standards department of the metallurgical division, Pittsburgh. His present title is staff metallurgist in the quality standards department.

Mr. McClintock is married and is the father of four children. He is deacon of the Hiland Presbyterian Church. Outside interests include golf, photography and household repairs and maintenance.

### NORTHEAST PENNSYLVANIA

JOHN J. PENKOSKE was born in Trenton, N. J., in 1917. After graduating from the parochial school in Trenton, he attended Drexel Institute of Technology, majoring in chemical engineering.

His first position upon leaving Drexel was with the laboratory staff of the John A. Roebling & Sons Co. In the early years of World War II he took a position with the U. S. Navy Department where he was employed for the duration. In 1947 he joined the research and development department of the American Car and Foundry Division of ACF Industries, Inc., as a staff metallurgist and presently holds the position of supervisor of technical services. During the Korean crisis, he served on the Ordnance Armored Vehicle Critical Materials and Boron Steel Committees at the Detroit Arsenal.

Mr. Penkoske married Josephine Ryan in 1945 and they have two charming daughters, Patricia Ann and Michale Mary, and one son, John, Jr.

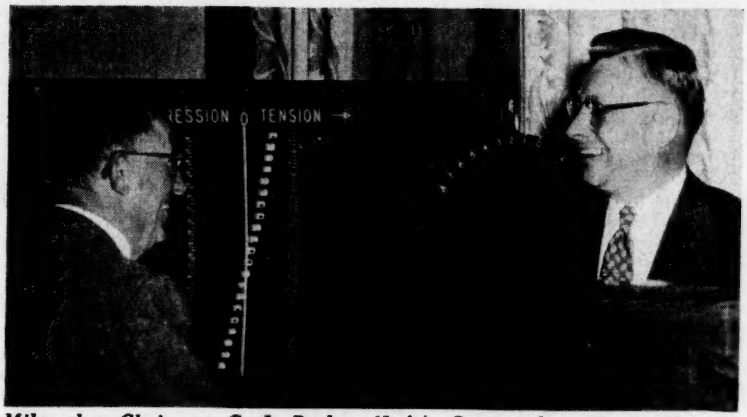
Mr. Penkoske doesn't spend all his waking hours glued to a metallurgical microscope. He is a member of the Loyal Order of Moose, Knights of Columbus and National Association of Foremen. He is active in church activities and is treasurer of one of the Berwick boy scout troops. His hobbies are bowling and golf.

*T. I. McClintock*

*F. Westermann*

*J. J. Penkoske*

## *Presents Talk on Residual Stresses*




*Milwaukee Chairman G. J. Barker (Left), Congratulates R. L. Mattson, General Motors Research Laboratories, Following Mr. Mattson's Talk on "Fatigue and Residual Stresses" at a Recent Meeting of the Chapter*

Speaker: R. L. Mattson
*General Motors Corp.*

R. L. Mattson, assistant head of the engineering mechanics department, Research Laboratories Division, General Motors Corp., presented a talk entitled "Fatigue and Residual Stresses" at a meeting of **Milwaukee Chapter.**

Mr. Mattson prefaced his talk with remarks concerning the influence of residual stresses on the work of the metallurgist and the mechanical engineer. By proper processing it is often possible to produce a residual stress pattern that will increase the stress capacity of the material, thus aiding the designer.

Experiences in the fields of fatigue and residual stresses, which indicated the general desirability of compressive stresses in surface layers, were related. A working model was used to illustrate the combined effects of applied and residual stresses.

Processing methods were classified as to the three general causes of residual stresses—thermal gradients, transformation and cold working. Data was shown on carburized parts which indicated a wide variability in surface residual stresses. Strain peening of leaf springs was shown to improve fatigue life tenfold over that of conventionally peened springs. Grinding causes large tensile residual stresses at the surface in a direction parallel to the grinding marks; such stresses can be minimized by light cuts. Tumbling was found to produce compressive stresses at the surface, this was also true for flame or induction hardening.

The standard method of residual stress analysis at General Motors Laboratories is to dissect the region to be studied and measure changes in surface strain with electric resistance gages and changes in curvature with a height gage, while progressively decreasing the metal thickness by grinding and electropolishing. Recent investigations using X-ray diffraction techniques have shown good correlation with the dissection method.

During the discussion period the effects of tempering in altering the residual stress pattern of a quenched part were considered. The speaker said there could be applications where tempering could damage a favorable residual stress pattern produced by quenching, and therefore be undesirable.—**Reported by P. W. Ramsey for the Milwaukee Chapter.**

## Circuit Speaker Explains Nondestructive Methods of Testing in Northwest

Speaker: Richard Turner
*Magnaflux Corp.*

"Nondestructive Testing in Industry" was the title of a talk given by Richard Turner, field enginer for Magnaflux Corp., before meetings of the **Puget Sound, Inland Empire** and **British Columbia Chapters.**

Mr. Turner stated that nondestructive testing in some form or another plays an important part in the manufacture and production of the things we use or encounter in our daily lives, for by its application in the manufacture of household appliances, public utilities and engineering projects, we can be assured that adequate standards for factors of safety have been met. One of the advantages of this method of testing is that the desired information on physical properties can be obtained without destruction of the article subjected to the test. The adoption of nondestructive testing will not only reduce costs in obtaining a better quality product, but will be amply justified in cases where a high number of rejects had previously been experienced.

Mr. Turner described the cost and pitfalls of inspection to tolerances set too tight. A profitable median between the designer and production man must be reached before nondestructive inspection pays its way.

Different methods of nondestructive testing and some specific examples of their use were illustrated and discussed. One very interesting and practical example was in the use of stress coat, a brittle lacquer-like coating which is applied to a part which is then subjected to service loads. Highly stressed areas are revealed by crack frequency observed in local areas of stress concentrations. The slides showed different designs at the same part and their most highly stressed areas under static service loads. Used in this manner, nondestructive testing is a "design prover". One type of stress coating is a ceramic-fired coat that is usable from —40 to 700°F. Most stress coatings are used under controlled temperature and humidity conditions. Various methods of crack inspection are used to better delineate the minute cracks present in the stress coatings. Statiflux is the most sensitive method used for ceramic stress coats.

Another comparatively new inspection device is the Sedac, which is an eddy current instrument used to detect seam depths in materials. Mr. Turner described how it is used as an automatic type of go-no-go gage for seam depth in pipe couplings, for instance. The instrument is similar to the Magnaflux Corp.'s Sonizon in appearance; however, the Sonizon is an ultrasonic instrument for determining wall thicknesses or flat discontinuities such as laminations.

Mr. Turner summed up his talk by stating that to properly evaluate a method of nondestructive testing, production cost versus scrap considerations must be looked into. The problem should be approached in a positive manner not only to find defects, but to prove the soundness of product and manufacturing process and to find and eliminate conditions that cause defects—**Reported by Ed Murray for Puget Sound and by J. S. Logie for British Columbia.**

## Furnace Refractories Sessions Scheduled

Under the auspices of the Metallurgical Engineering Committee of the Institute of Metals, Great Britain, an all-day informal discussion on "Furnace Refractories for the Use of the Nonferrous Metal Industries" will be held at the University of Birmingham, England, on Friday, Feb. 24, 1956. An invitation has been extended to all A.S.M. members by the Institute to attend these sessions . . . no tickets are required.

## Outlines Trends in High-Speed Drill Design and Use At Springfield Meeting

Speaker: W. R. Frazer
*Union Twist Drill Co.*

At a joint meeting of the **Springfield Chapters** A.S.M. and A.S.T.E., W. R. Frazer, chief metallurgist, Union Twist Drill Co., described "Trends in High-Speed Steel Drill Design and Metallurgy".

Dr. Frazer pointed out the severity of service demands upon twist drills, stating that it is the only cutting tool constantly in contact with the workpiece and at the same time cutting a hole equal to its own size. Furthermore, the deeper the hole, the farther the cutting edge from the coolant, and hence the greater the need for hot hardness. Dr. Frazer then went on to describe a number of different kinds of drills.

The slow-spiral drill, which is also called a brass drill, is used for brass, thin metal, and alloys having a low tensile strength. It is also good for brittle nonmetals, such as asbestos and hard rubber. The drill has a wide flute to accommodate the chips.

Another drill used for low-tensile materials is the fast-spiral drill. This is particularly suited to zinc, aluminum and magnesium-base alloys. It is sometimes used for ferrous metals, though not widely so. It has a polished flute so as to reduce the coefficient of friction between tool and chip.

The standard or general purpose drills are of two types: (a) Ferrous oxide-coated; and (b) polished flute. In drilling steel, ferrous oxide-coated drills out-perform other types since ferrous oxide decreases welding of chip to tool surface and is reputed to act as a lubricant for chip movement. Superior properties may also result from relief of some grinding stresses during the oxide coating.

Heavy-duty drills are designed with a heavier web section. Dr. Frazer pointed out that drills are essentially helical springs held together by the web. The drill vibrates, like a spring, as it cuts. The harder the material, the more severe the vibration. Since vibration causes breakage, the heavier the web, the harder the material which can be drilled. In heavy-duty drills, the web at the point is standard, but it increases more quickly than in standard drills. Dr. Frazer stated that two-thirds of the thrust is required to drive the chisel edge on the end of the drill, and only one-third to drive the lips.

Cotter-pin drills are designed to drill holes in hardened steel shafts. The drill walks if it does not immediately start to cut when brought in contact with the work. Also, if not stiff enough, the tendency to walk or slip off the round workpiece is increased. Hence, cotter-pin drills have a heavy web and are ground with a special point known as a notch or crankshaft point. This type of point has two cutting lips for each single lip found on a standard drill. A short secondary lip leads a longer secondary lip. These drills are also useful for drilling materials which are very hard or have high coefficients of work hardening.

Cobalt drills are used for material whose tensile strength is as high as 225,000 psi., whereas the heavy-duty drills are good only up to about 175,000 psi. tensile.

Carbide-tipped drills are very useful for cast iron. In cast iron, a carbide-tipped drill runs twice as fast and has four times the life of a high-speed drill. At the same speed as a high-speed drill, the carbide-tipped drill has about 10 times the life of the high-speed drill. Carbide drilling of steel has not worked out too well as yet, because carbide tends to crater at low speeds. Since the speed of the chisel is zero at the center, it might be expected that cratering would be troublesome.

Oil-hole drills and oil-groove drills are also available. These are useful for larger hole sizes and for deep holes. Hole depth should exceed hole diameter by at least five times if these drills are to be used advantageously. Oil grooves deliver four times the volume of coolant as oil holes.

Dr. Frazer pointed out that, according to his studies, M-1 generally has finer grain sizes than M-2 or M-10 when all are hardened to the same hardness. It has also been noted that M-3 has finer carbides than M-1 or tungsten high speed steels in general. This finer distribution of carbides is believed to be partly responsible for the better abrasion resistance of M-3. Not only carbide distribution, but the kind of carbide present, affects drill performance. The more vanadium carbide present, the greater the wear resistance of the drills.—**Reported by Carl A. Keyser for Springfield Chapter.**

## *Extrusion Processes Topic at Oregon*

*Oregon Chapter Members Heard Gilbert A. Moudry, Chief Metallurgist, Harvey Machine Co., Speak on "Extrusion" Recently. Shown, from left: J. E. Gustafson, chairman; Mr. Moudry; and J. P. Bates, vice-chairman*

Speaker: Gilbert A. Moudry
*Harvey Machine Co.*

"Extrusion" was the subject discussed by Gilbert A. Moudry, chief metallurgist, Harvey Machine Co., at a meeting held by the **Oregon Chapter** recently.

Mr. Moudry discussed the process of extruding aluminum, steel and titanium. Aluminum extrusions have been made for about four years but only recently has the extrusion process been applied to steel and titanium. Extruded sections provide a high degree of versatility and there is an expanding field of applications for extruded sections.

The aircraft industry requires large extrusion presses, of 8000 to 12,000 tons capacity. Sections difficult to roll by present methods, more efficient structural design, production of small lots of complicated parts, elimination of forging and machining and rolled-in slivers, are some of the advantages of extruded parts mentioned by Mr. Moudry.

Speed is a prime requisite to eliminate formation of scale, which will damage the dies. Extrusion dies for steel—cast or wrought, depending on cost—are lubricated with molybdenum disulphide.

The quality of steel extruded sections are equal to rolled sections. However, properties are almost equal to longitudinal properties. Titanium is very difficult to extrude and must be heated in an inert atmosphere.

Mr. Moudry illustrated his talk with samples of aluminum, steel and titanium extruded sections.—**Reported by T. B. Mathisen for Oregon.**

**created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.**

## *Gives Steel Heat Treating Pointers*

*D. R. Edgerton, Metallurgist, Lindberg Steel Treating Co., Talked on "Practical Heat Treatment of Steels" at a Meeting of the Boston Chapter. At the meeting were, from left: W. F. Collins, program chairman; D. M. Robinson, technical chairman; Mr. Edgerton; and J. L. Morosini, chairman*

Speaker: D. R. Edgerton
*Lindberg Steel Treating Co.*

D. R. Edgerton, sales metallurgist for the Lindberg Steel Treating Co., presented a tak on the "Practical Heat Treatment of Steels" to the **Boston Chapter** at the first meeting of the current season.

Mr. Edgerton presented many practical solutions to problems that have long been a source of concern to tool designers, heat treaters and production engineers. He discussed the progress that has been achieved in steelmaking and furnace equipment as well as tool design.

Steel producers have made great strides in perfecting their product through closely controlled inspection procedures. The furnace manufacturer has made possible the control of surface chemistry and carbon restoration through the use of modern furnace equipment.

The design engineer plays a very important part in minimizing heat treating failures, and he should visit the hardening room often to become acquainted with the hazards brought about by poor design. While it is not always possible to utilize ideal design in a tool or die, it is helpful for the designer to work with the heat treater to minimize heat treating losses. Many parts lost in heat treating could have been salvaged by increasing the wall thickness, adding a radius to a sharp corner or through better balance of section.

The speaker pointed out other hazards in heat treating, including parts which are improperly identified as to grade and desired hardness. He suggested that the use of a sketch of the part containing the necessary information might be employed when other means are impractical.

Decarburization due to insufficient removal of stock or improper furnace atmosphere usually results in grinding checks or heat treating cracks.

Size change in heat treatment has often been the cause of many extra hours of labor in order to salvage a part. The so-called double treatment is an excellent method of predicting size change before final heat treatment. The method involves rough machining to within 1/16 in. of finished dimensions and heat treating to the desired hardness. The part is measured before and after this treatment for size change. The part is annealed, finish machined, allowing for one-half of the original size change, and then rehardened. The cost of the extra treatment is generally considerably lower than standard and is more than offset by the reduced extra labor often encountered in finishing.

The speaker illustrated many parts that were produced by the double treatment method that would have resulted in disaster had they been finish machined prior to hardening.

Marquenching, carbonitriding, deep freezing and other special treatments were discussed. Some commercial hardeners use a temperature slightly below the Ms point to obtain maximum hardenability during marquenching procedures. Equipment and applications involving carbonitriding were illustrated to show the progress which has been made in equipment and heat treating technique.—**Reported by William H. McCarty for the Boston Chapter.**

## *Machinability Factors Pointed Out*

*J. Dickason (Left), Program Chairman, D. W. Murphy (Center), Bethlehem Steel Co., and R. J. Tremblay, Technical Chairman, Are Shown During a Meeting in Los Angeles at Which Dr. Murphy Spoke on "Machinability"*

Speaker: D. W. Murphy
*Bethlehem Steel Co.*

"Some Metallurgical and Mechanical Aspects of Machinability" were pointed out to members of the **Los Angeles Chapter** by D. W. Murphy, division head of steelmaking research, Bethlehem Steel Co., at a recent meeting. Dr. Murphy supplemented his talk with the film "This Is Steel" and numerous slide illustrations.

Dr. Murphy defined machinability in terms of the following: (1) material cut; (2) the machine tool; (3) cutting speed; (4) cutting tools; (5) cutting fluids and lubricants; and (6) operator skill.

Various machinability tests are performed in different ways, the speaker explained. In general, a gage of machinability is the amount of material removed or the number of pieces produced during a given time with adequate surface finish and within accepted tolerances.

Taking into account the large number of steels machined of different analyses, along with many other variable factors, Dr. Murphy pointed out that 165,888,000 combinations are mathematically possible. Even with only one grade of steel, 8,503,056 variations are possible.

Slides illustrating the talk showed microstructures and data pertaining to machinability. Photomicrographs and photomacrographs illustrated material characteristics as well as characteristics of tool wear and chip formation.—**Reported by Robert H. Lundquist for Los Angeles.**

# Metallurgical News and Developments

***Devoted to News in the Metals Field of Special Interest to Students and Others***

A Department of *Metals Review*, published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

**Corrosion Conference**—The department of engineering, University of California, will conduct a conference on marine corrosion from Apr. 18 through 20 on the La Jolla campus of the university.

**Adds Division**—The Silicones Division, Union Carbide & Carbon Corp., has been formed to take over the responsibility for the development, manufacture and sales of silicone products. The new division will assume responsibilities previously handled by Linde Air Products Co. in the field of silicones.

**Research to Boom**—Industrial and scientific research in the U. S. should reach another new high in dollar volume in 1956, according to Clyde Williams, president and director, Battelle Memorial Institute, who predicts a national expenditure of $4½ billion for industrial and governmental research.

**Portable Reactor**—A nuclear generating station now under construction for the Army by Alco Products, Inc., is designed so that its components can be transported by air to remote locations anywhere in the world.

**Tap Furnace**—The nation's largest vacuum melting furnace was recently tapped by Vacuum Metals Corp., Syracuse. The furnace is remotely operated by the melter, who can control from one console charging, mold transfer and pouring operations.

**Titanium Production**—C. I. Bradford, president and general manager, Rem-Cru Titanium, Inc., announced that production orders for military aircraft placed by the Air Force in the fourth quarter of 1955 have assured a major expansion of the use of titanium mill products in 1956.

**Atomic Conference**—A two-day conference to alert business and commercial leaders of the Southwest and Mexico to the significance of atomic energy will be held at San Antonio, Tex., on May 10 and 11, 1956. Southwest Research Institute of San Antonio will sponsor the conference in cooperation with the Atomic Industrial Forum.

**Ferro-Alloys**—Total steel production in 1955 rose to 117,000,000 ingot tons, or 33% above 1954 deliveries. The output of alloy and stainless steel rose 45%, however, from 7,150,000 to approximately 10,650,000 tons.

**To Build Lab**—A $750,000 applied research and development laboratory to improve foundry processes and products will be established at General Electric Co.'s foundry department, Schenectady. Jack Keverian, member of the Eastern New York Chapter A.S.M., will head the lab.

**Create New Department**—A technical products sales department has been set up by the Bausch & Lomb Optical Co., Rochester, N. Y., to permit more efficient handling of the growing Bausch & Lomb product line and to help free sales executives for their sales promotion activities.

## *New Haven Members Tour Steel Plant*

*Members of New Haven Chapter Toured Wallingford Steel Co. and Heard a Talk on the "Development and Future of Wallingford" by W. H. Grinold, Vice-President of Operations. Shown, from left: Gus Weldon, Chapter chairman; Mr. Grinold; and Joseph Wilton, technical chairman of the meeting*

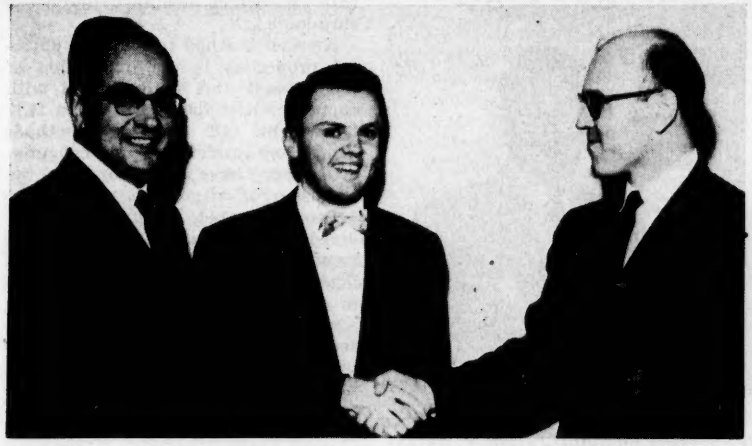
Speaker: W. H. Grinold
*Wallingford Steel Co.*

Members of the **New Haven Chapter** heard W. H. Grinold, vice-president of operations, Wallingford Steel Co., present a talk on the "Development and Future of the Wallingford Steel Co." prior to taking a tour of the company's facilities recently.

Wallingford Steel Co. was organized and built in 1912 by E. B. Cleborne (now president of the company), and G. D. Boyd. The company grew from a production of 6000 tons, amounting to $600,000 in sales annually, to its present volume of 60,000 tons, with an annual sales of $25,000,000. The company first produced carbon steel and, in 1928, started production of stainless steel. In 1949, operations were expanded to produce stainless tubing and piping. In 1935 controlling stock was acquired by Ludlum Steel Co. and in 1938, when Ludlum Steel and Allegheny Steel Co. merged, Wallingford became part of that corporation.

The stainless steel and alloy production in the plant has risen considerably faster than production of low carbon steel. Wallingford is now producing superalloys, such as A286 and AM350, Hastalloys, as well as titanium. The company has recently been granted an access permit by the Atomic Energy Commission to better acquaint themselves with the problems peculiar to the use of materials for atomic energy uses, and is in the process of putting automation to work in the plant wherever possible. Metallurgical facilities also are being expanded, and a recent addition has been a complete X-ray laboratory, including equipment for X-ray fluorescence analysis.—**Reported by K. L. Tingley for New Haven.**

## *Presents Detroit Educational Lecture*



*J. J. Gilman (Center), First Speaker in a Series of Two Educational Lectures Which Were Presented by Detroit Chapter, Is Shown With Joseph Gurski (Left), Chairman of the Educational Committee, and Edward Marande, Technical Chairman. Dr. Gilman presented a talk entitled "Dislocations"*

Speakers: J. J. Gilman
W. R. Hibbard, Jr.

*General Electric Research Lab.*

Considerable interest was shown in the two educational lectures given by the **Detroit Chapter.** The lectures, which were of a more advanced nature than those normally presented in the Detroit educational series, were presented by J. J. Gilman and W. R. Hibbard, Jr., both of General Electric Research Laboratory.

Dr. Gilman covered "Dislocations" in the first lecture. A dislocation was defined as the boundary line between two regions of a solid. One of the regions has a displacement in it, the other does not. Dr. Gilman, for the purpose of illustration, compared a dislocation to a bump in a rug. By pushing this bump along until it reaches the opposite side of the rug it is possible to move the entire rug. On the other hand, it would be quite a task to move all the bumps in a badly rumpled rug. In one case the bump or dislocation was useful in that it could be used to move the rug, while in the other it was not useful and created a problem. In metallurgy, as in the case of the rug, dislocations can be useful or harmful. They aid the metallurgist by making metals plastic, by speeding up processes like carburizing and age hardening, and by helping to make strong permanent magnets. On the other hand, they act against the metallurgist by hardening deep drawing materials and causing fracture to occur.

Two types of dislocations, the edge and screw type, were discussed and deductive evidence for their existence was presented. Several successful predictions based on dislocations were shown. One of these, the growth of a cadmium iodide crystal at a dislocated area, was shown on a color slide. Photomicrographs of etch pits were presented as direct evidence of the presence of dislocations.

Increased rate of diffusion at dislocations was discussed by Dr. Gilman, along with evidence indicating extremely high tensile properties exhibited in "perfect" metallic crystals, nominally free of dislocations. Nucleation, as well as the impeding of fractures by dislocations, was explained.

In the second lecture, Dr. Hibbard, manager of the alloy studies section, presented a summary of contemporary knowledge on the "Origin of Textures".

Interest in textures stems from studies involving direction differences in properties and behavior. Investigation of problems involving magnetization have also indicated the importance of textures. Control of textures has, therefore, become a matter of considerable interest.

Dr. Hibbard gave an explanation of stereographic projection, a means of representing a three-dimensional arrangement in a two-dimensional diagram.

The techniques of determining crystal orientation, by means of X-ray reflection, and the presentation of the resulting data in the form of pole figure charts was covered.

Dr. Hibbard also gave a summary of the historical aspects and development of the present thinking concerning recrystallization textures, pointing out that there are now two conflicting theories on grain formation. One of these is that grain formation is initiated in areas of low stress, while the other supports the belief that highly stressed areas are more influential. In the recrystallization of deformed metals in which a preferred orientation exists, the preferred orientation will continue to exist after recrystallization. Recrystallization is, in effect, the removal of dislocations.

Slides illustrating the recrystallization of deformed brass upon reheating were presented. Formation of new grains in the brass was taking place initially along previous grain boundaries and slip planes.

In summary, Dr. Hibbard stated that after the fact rationalizations of why a deformation texture formed have been made by many investigators; however, a theory has yet to be developed on which predictions of textures can be made. Present systems are qualitative at best.—**Reported by G. M. Lahr for Detroit.**

## *At Philadelphia*

*Francis G. Tatnall, Manager of Testing Research, Baldwin-Lima-Hamilton Corp., Spoke on "New Developments in Mechanical Testing" at a Meeting in Philadelphia. He emphasized testing of complete structures rather than laboratory specimens, and use of unusual measurements by electronic equipment at very fast rates. (Reported by L. Calzi)*

## N. W. Pennsylvania Hears Closed Circuit Melting Talk

Speaker: J. D. Nisbet

*Universal-Cyclops Steel Corp.*

At a meeting of the **Northwestern Pennsylvania Chapter,** J. D. Nisbet, director of research, Universal-Cyclops Steel Corp., presented a talk entitled "Closed Circuit Melting".

After a brief summary of the historical background of vacuum melting, the speaker elaborated on the progress in this field of metal technology by comparing the control which is possible to attain in the electric arc furnace, the vacuum induction furnace, the vacuum arc consumable electrode and the levitation furnace and describing advantages and disadvantages of each method.

Mr. Nisbet then described the present closed circuit melting installation which is in operation at the Universal-Cyclops plant in Bridgeville, Pa., and illustrated numerous points of interest with slides.

Mr. Nisbet answered several questions regarding the equipment used in the present installation and questions about control, technology and the future of this type of melting. —**Reported by W. W. Lynch, Jr., for Northwestern Pennsylvania Chapter.**

## *Reports on Powder Metallurgy Progress*

*Fritz V. Lenel, Professor of Metallurgical Engineering, Rensselaer Polytechnic Institute, Presented a Talk on "Powder Metallurgy" at a Recent Meeting Held by the St. Louis Chapter. Shown are, from left: Harold C. Pfeffer, Chapter secretary; Dr. Lenel; and Julius Turk, Chapter chairman*

Speaker: Fritz V. Lenel
*Rensselaer Polytechnic Institute*

A recent meeting of the **St. Louis Chapter** was held jointly with the A.S.T.M. and the Engineers Club of St. Louis. Fritz V. Lenel, professor of metallurgical engineering, Rensselaer Polytechnic Institute, presented a talk on "Powder Metallurgy".

Dr. Lenel stated that the process of compacting and sintering powdered metal into useful shapes is older than the fusion process. However, the first modern approach to this process was not made until early in the 19th century. At that time, platinum powder was made by chemical extraction, then pressed into bars and finally sintered. The next important commercial step came in 1910 when tungsten was sintered into rod, swaged and drawn to wire for incandescent lamps.

In the early 1920's, self-lubricating bearings of powdered metals made their debut, followed a short time after by sintered carbides for cutting tools.

Structural parts made of iron powder in the 1930's were low in density, being approximately 75% the density of wrought products. This low-density problem has been overcome by using highly compressible electrolytic iron powder, higher compacting pressures and the additional operations of repressing and resintering. Thus, small gears and irregularly shaped machine parts are now being made commercially competitive at 99% the density of wrought parts of such analysis as SAE 1010. Higher impact and wear resistance is obtained by carburizing and hardening in the conventional manner.

Sewing machine parts, made of 98% iron powder and 25% copper, having a tensile strength of 56,000 to 63,000 psi., yield of 50,000 to 53,000 psi. and elongation of 12 to 18%, were shown by Dr. Lenel. With other additives to the powder, strengths are available up to 100,000 psi.

Sintered carbide die walls have been useful in overcoming the wearing effect of the iron powder on the compacting dies.

The attempts to add elemental nickel, manganese, silicon, etc., to electrolytic iron powder to make alloyed parts have not been too successful, due to the slow diffusion rate of these elements in the sintering temperature range. Therefore, alloy steel powders have been employed for this purpose. Some work done with SAE 4630 compressed and sintered, followed by two repressings and two resinterings, has yielded parts in tensile up to 150,000 psi., but with low elongation.

Density and strengths have also been increased by employing higher temperatures for sintering, such as 2375° F., which results in increased shrinkage.

Another method to increase physical properties is the infiltration of the pressed and sintered part with copper or a copper alloy up to 25% by weight. Of the many methods being used to increase physical properties, none have been adopted to the exclusion of all others.

Semifabricated, nonferrous powdered products have been manufactured of aluminum and magnesium. Probably the most striking advances in this field have been made with aluminum. Aluminum oxide as a second phase in these products was first considered detrimental, but in finely distributed form, as it is obtained when aluminum flake powders are hot pressed and then extruded, it gives greater strength. A material of 7.8% aluminum oxide has a tensile strength of 39,000 psi. compared to a 16.5% oxide at 54,000 psi. Even more surprising is the elevated temperature strength of sintered aluminum but there is a severe loss of ductility.

Dr. Lenel warned against becoming too enthusiastic or discouraged with the progress of powdered metals as a great part of the work to be done is still in the experimental stage. The commercial production of parts from powdered titanium and zirconium is feasible. Some work has been done feeding various metal powders between rolls to produce strip. Attempts to produce tube have not yet been successful. There are a number of applications awaiting their turn in the research laboratories which may yield startling results for the future.—**Reported by Robert D. Leslie for St. Louis.**

## *Heat Treating Topic at Western Ontario*

*A. E. "Hap" Henri, Supervisor of Heat Treating, Ford Motor Co. of Canada, Ltd., Spoke on "Heat Treating Water Hardening Toolsteels" at a Meeting Held by the Western Ontario Chapter. Shown are, from left: Frank Miller, chairman; Mr. Henri; B. J. Blair, vice-chairman; H. T. Gunther, Ford Motor Co. of Canada, Ltd.; and I. S. Reid, Ford Motor Co. of Canada, seated at the piano. (Reported by Miss R. V. Hutchinson)*

## Explains Factors Involved In Aircraft Stresses at Meeting in North Texas

Speaker: Doyle Brooks

*Temco Aircraft Co.*

At a meeting of the **North Texas Chapter,** Doyle Brooks, structural engineer, Temco Aircraft Corp., gave a talk on "Stress Analysis".

Mr. Brooks started by asking, what is stress, phonetic stress, overstress, mechanical stress, and torsion and shear stress? He then defined t e n s i l e, compressive, and shear stresses as encountered in the designing of new aircraft.

Stress analysis is the simple determination of the existence of stresses. The actual start of an analysis is to determine loads which exist. Mr. Brooks discussed the effects of pulling an aeroplane out of a dive and stated that the greatest expected load factor is determined as six times the load of the airplane. He also illustrated the rolling pull-out and unsymmetrical loads involved.

The speaker then discussed the stresses applied when an airplane encounters updrafts and downdrafts, the distribution of air pressure over the wing and lifting force distribution and stresses involved.

Mr. Brooks explained the I-beam principle of controlling stress in wings and discussed buckling of the wing before the material reaches the yield point. He explained deflection and dynamic stress vibration frequency and mentioned that flexible wings could not be tolerated in high-speed aircraft and that the leading edge of wings distributes thermal stresses over the surface.

Mr. Brooks touched briefly on design and how the designer likes to put three spars in the wing, which set up uneven stresses. He discussed internal load conditions of pressurization and how the landing gear absorbs severe impact forces, as well as the dynamic forces involved during landings.—**Reported by Robert E. Hopper for North Texas.**

## Extrusion of Aluminum Discussed at Puget Sound

Speaker: G. Moudry

*Harvey Aluminum Co.*

G. Moudry, chief metallurgist, Harvey Aluminum Co., presented a talk entitled "Extrusion of Metals" at a meeting held recently by the **Puget Sound Chapter.**

Mr. Moudry stated that extruding is the best way of fabricating metals, especially where particular metallurgical properties and particularly close tolerance configurations are desired.

In shaping a part, the extrusion process works the metal from the billet to the finished extrusion more thoroughly and uniformly than any other method.

The process of extruding is relatively new. It is used mainly for aluminum but is also successful with copper-base alloys, high strength and stainless steels. Work is now being done on the extrusion of high temperature steels.

Extruding has the highest efficiency of any major fabricating process. One of the chief advantages of extruding over forging is the elimination of draft allowances. Saving of critical materials was also cited as an advantage of the extrusion process.

The aircraft industry is utilizing high strength steel extrusions that were formerly made of aluminum. These same designs are too difficult or costly to be shaped by any other process. Either cast or wrought stock can be used for the basic material without altering the properties of the finished product.

There is considerable difference in the extruding practice of aluminum and steel. Although aluminum is softer and not as strong, it is more difficult to extrude. Aluminum alloy 7075 is extruded at about 5 ft. per min. at a temperature of 750° F. Steel is extruded at speeds up to 1000 ft. per min. at 2250° F. Pressures required for steel are greater than for aluminum. Speed is essential for steel in order to reduce the time the hot steel is in contact with the die and tooling.

Lubricants are necessary for steel extrusions as an antifriction medium and as insulating skin to protect the tools. Refractories, such as glass, have proven efficient although other lubricants are in use.

Titanium, which is still being developed in the extrusion field, and steel are difficult to straighten after extruding, whereas no difficulty is encountered with aluminum. Steel must be normalized or annealed. In the extruding process, steel is recrystallized so as to give the finished extrusion equal longitudinal and transverse properties. However, due to the large grain size resulting from forming considerably in excess of the critical temperature, steel extrusions should be heat treated before being used.

The utilization of extrusions has been expanding. Titanium alloys, 410 and 431 crs, nearly all 300 series crs, and the newer precipitation hardening stainless steels have all been successfully extruded. The only limiting factor is the size of the available extrusion presses.—**Reported by Edward E. Murray for Puget Sound Chapter.**

## *Hold Annual Barbecue at Golden Gate*

*Shown Having a Good Time at the Annual Barbecue and Golf Tournament Held by the Golden Gate Chapter Are, Standing, From Left: Manny Goulart, Pro Manager of the Hillview Golf Course; Vic Walberg, Chairman of the Golden Gate Chapter; and Tom Hutton, Host of the Evening*

Slightly over 300 Northern California members and guests gathered for their annual golf tournament and barbecue recently as guests of Tom and Sonny Hutton at the Hillview Golf Course, in San Jose. The huge turnout marked the sixth consecutive year that Tom, a pioneer in A.S.M.'s western history, has played host to **Golden Gate** members.

Approximately 60% of the group made a day of it by playing golf. A loaded buffet table provided ample sustenance, in solid form, throughout the afternoon. For dinner, all members enjoyed king-sized barbecued steaks with all the trimmings.

Tom and his son are representatives in San Francisco.—**Reported by R. Failor for Golden Gate.**

# *Educational Course Draws Capacity Crowd*

*A Record-Breaking Total of 303 Persons Registered for a Five-Lecture Course Conducted by J. J. Connelly, American Brake Shoe Co., for New Jersey Chapter. A $3 registration fee was charged and each registrant received a copy of the A. S. M. book "Fundamentals of Metallurgy". The course was arranged by the educational committee under the chairmanship of S. G. Lindstrom. (Reported by K. B. Baker)*

## Explains Problems To Be Overcome in Automobile Corrosion at Rochester

Speaker: J. C. Holzwarth
*General Motors Corp.*

J. C. Holzwarth, Research Laboratories Division, General Motors Corp., presented a talk on "Corrosion Problems in Automobiles" at a meeting of the **Rochester Chapter.**

Mr. Holzwarth stated that since 1940 the highly competitive automotive industry has been greatly concerned with the varying degrees of severity of corrosion problems encountered in automobiles.

According to industry reports, passenger cars are being scrapped at the rate of about three million per year and nearly all are rusted beyond economic repair. The average life of cars scrapped in 1925 was 6½ years, whereas this figure has increased to 13½ years in 1951, this longer life being due primarily to improved durability of engines and other mechanical parts.

*J. C. Holzwarth*

To keep pace with these mechanical advances, considerable emphasis has been placed on better design and protective undercoatings in an effort to extend the service life of the body structures. On the contrary, there has been no significant improvement in the corrosion resistance of auto body sheet steel in the last 25 years.

Mr. Holzwarth divided body corrosion into two types: Exterior surfaces which are easily detected and readily controllable by the accepted methods of polishing, waxing and touch-up painting; and that which causes rapid deterioration and perforation of body components. The latter is more insidious and occurs most often in sheltered areas, such as interiors of rocker panels, inside doors and window wells, or in crevices of the underbody. Corrosion in these regions is accelerated because the rust formed is nonprotective.

Results of investigations have shown that "sheltering action" greatly accelerates corrosion by retarding protective rust formation. The washing action of water on exposed steel aids protective rust formation by removing soluble corrosion products. If this action is restricted by the steel remaining wet for long periods of time, the rust remains porous and nonprotective, which greatly speeds up corrosive attack.

Improved design to eliminate crevice areas would help to eliminate the cause but, however desirable this may be, it is often inconvenient or impractical. Also, continuous coating with mastic materials is limited by the inaccessibility of many areas.

Obviously, one of the best places to reduce corrosion is in the steel itself and a grade which corrodes at ¼ to ½ the rate of presently used rimmed steel would show the required improvement. However, from the tests performed on many grades so far, it has been concluded that the increased cost is not justified and that fabrication problems would be multiplied many times over.

The program of testing which is constantly being carried on presents numerous difficulties to simulate actual service conditions and to arrive at suitable conclusions without involving a lengthy period of testing. To accelerate this procedure, General Motors Research has developed a "cyclic humidity accelerated corrosion test" which appears to give satisfactory answers within 20 days. Corrosion weight loss is comparable to 3 and 3½ years of atmospheric exposure at Bayonne, N. J., and Kure Beach, N. C., respectively.

To further complicate the testing program, it has been found that the addition of the more common alloying elements in steels in varying amounts produces different results between outdoor exposure and "sheltering action" conditions.

While carbon contributes no noticeable improvement in outdoor tests, it is the most potent element in reducing corrosion under "sheltering action" situations. Unfortunately, high carbon steels are not practical because of their poor forming characteristics but present work is being directed to finding an additive or combination of elements which, like carbon, will produce increased corrosion resistance at low cost and not affect forming procedures.—**Reported by Frank J. Gehrlein for Rochester Chapter.**

## Light Metals Convention

On June 7 to 9, 1956, the Third International Light Metals Convention will be held at the Montanistische Hochschule at Leoben, Austria. As was the case on previous conventions in 1934 and 1948, a survey will be given on the present state of light metals development. Lectures will be given by leading experts from Europe, Canada and the U.S.A., and will cover the following fields: Light Metals in the National and World Economy; Metallurgy of the Light Metals (Al, Mg, Ti); Technology of Light Metals; Metallography and Physics of the Light Metals; and Development of the Light Metals.

A detailed program will be published early in 1956. Information may be obtained from the Committee of the Third International Light Metals Convention, Leoben/Stmk., Austria, Montanistische Hochschule, Institut fuer Metallkunde.

## Employment Practices Outlined for Students

A subject of vital interest to all prospective metallurgists was presented at a meeting of the **Penn State Chapter** when representatives of the ferrous and nonferrous fields discussed the interviewing procedures used by their companies in talks on the "Training and Placement of New Employees."

F. H. Illig, personnel manager, New Kensington plant, Aluminum Co. of America, described general aspects of interviewing procedure and the desirable characteristics which Alcoa seeks in the young graduate.

Alcoa uses a procedure which involves formal application, prescreening and interview with a prospective employee. This procedure is designed to obtain a deeper insight into the applicant's character, ambitions, personality and leadership potentialities. Scholarship does not carry an unrealistic proportion in the choice of a new employee, and, whereas completed military service is desired, it is certainly not a prerequisite. Alcoa is also looking for those metallurgists who are capable of clear and concise written and oral expression. The leadership potentialities and will-do attitude in the prospective employee are of primary importance.

W. D. Stewart, staff metallurgist, fabricating division, Aluminum Co. of America, described how the new employee is introduced to his responsibilities. Newly employed metallurgists are assigned to specific openings in either the smelting, casting or fabricating divisions. On-the-job training and rotation of jobs in line with advancement is to be expected. Alcoa expects metallurgists to have a good background in physical metallurgy and basic engineering sciences if they are to capably perform duties relating to the production side of the operations.

H. C. Houghton, assistant to the manager of personnel, Bethlehem Steel Co., who represented the ferrous industry, stated that his company is generally interested in stability, past performance and the references of others when considering a prospective employee. Bethlehem also hires regardless of the applicant's military obligations. Mr. Houghton stressed the importance of past performance as a guide to probable capability of the applicant in a subsequent job.

When the engineer is hired, he may obtain a comprehensive introduction to the Bethlehem organization through the well-known "loop course", which begins with a five-week orientation period, during which a new engineer becomes acquainted with many aspects of plant operations.

Mr. Houghton made it clear that metallurgists in particular have almost unlimited opportunities, whether in sales, production, management or research.—**Reported by Ralph G. Dermott for Penn State.**

## *Presents Charter at Quebec Meeting*

*At the Charter Meeting of the Quebec Chapter, G. M. Young, Technical Director, Aluminum Co. of Canada, Ltd., and A.S.M. Trustee, Presented a Talk on the "History of Aluminum Alloy Development". Shown are, from left: H. P. Tardif, vice-chairman; G. Letendre, chairman; and Mr. Young*

### Speaker: G. M. Young

***Aluminum Co. of Canada, Ltd.***

At a meeting of the recently formed **Quebec Chapter**, G. M. Young, technical director, Aluminum Co. of Canada, Ltd., and A.S.M. trustee, presented the Charter to the Chapter, and briefly outlined the present work and future plans of A.S.M.

Mr. Young then presented a paper on the "History of Aluminum Alloy Development", tracing the story of aluminum from its birth 130 years ago to the present state of complex and highly efficient alloys.

From 1854 to 1886 the metal was produced by sodium reduction. Applications, during this early stage included jewelry, lace wire for uniform decoration, babies' rattles, optical instruments and also, under the patronage of Napoleon III, helmets and sword hilts. The metal employed contained about 97.98% aluminum, with iron and silicon as the principal impurities.

In 1859, St-Clair Deville commenced his pioneer work on alloy additions, and an interesting development by Savard in 1854 was a clad product having a "veneer" of aluminum on brass sheet.

The year 1886 saw the beginning of the electrolytic process and this development reduced the price from $17 to $2 per lb. and opened up the way for large-scale production of aluminum.

Mr. Young outlined the development of alloys, one of the earliest containing 33% zinc being used in Europe by Zeiss for cast binocular casings. In America, alloys with 8% copper were preferred as they provided a better compromise in casting characteristics and mechanical properties. Modification of the eutectic aluminum-silicon alloys for sand castings represented a major advance in alloys of this type and was the basic composition from which several sand and permanent mold piston alloys were developed.

The field of heat treatment of aluminum alloys was opened by Wilm's work on rolled alloy for cartridge cases, leading to the introduction of duralumin and its subsequent modifications. Gallini's introduction of artificial aging by heating to a controlled temperature was the next major step.

Mr. Young outlined the properties and problems associated with the binary aluminum-magnesium alloys, notably their tendency to stress-corrosion susceptibility when the magnesium content is above 5%. He also discussed the heat treatable magnesium-silicide alloys and the high-strength 75S-T type.—**Reported by J. E. Chard for Quebec Chapter.**

## Elected President

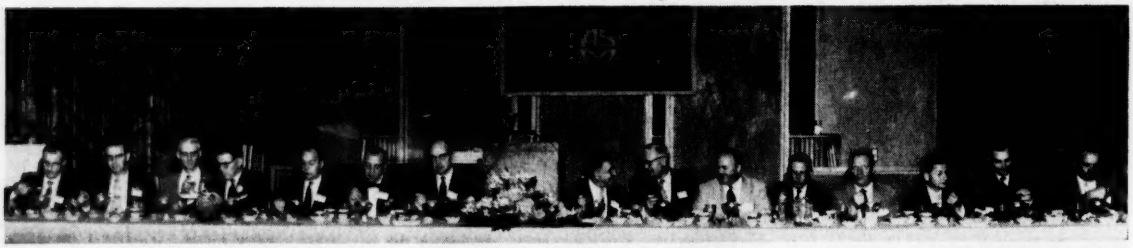
James D. White, Jr., member of the Cleveland Chapter, has been elected president of Darwin & Milner Inc. For the past five years, Mr. White has been vice-president and general manager for Darwin & Milner, the originators of high-carbon, high-chromium die steels.

*J. D. White, Jr.*

A pioneer in the toolsteel field, Darwin & Milner introduced the first high-carbon, high-chromium die steels into this country from Sheffield, England. Trade names such as PRK-33, Neor, and Darwin #1 are widely known in the industry.

Prior to his association with Darwin & Milner Inc., Mr. White had spent 17 years with Crucible Steel Co. of America, six years of which he was district manager of the Milwaukee branch.

# *Hold Southwest Metals Conference in Texas*



*At the First Annual Southwest Metals Conference, Sponsored by the North Texas Chapter, Were, From Left: Jim Piccone, Stephen Maszy, Robert Hopper, John Turbitt, F. V. Lenel, J. P. Fowler, Erik Jonsson, Irving Comroe, Earl Casey, F. McKimball, W. C. Brown, G. Dehn, Albert S. Holbert, T. E. Bass and C. E. Perkins*

The first annual meeting of the Southwest Metals Conference and Industrial Exhibits sponsored by the **North Texas Chapter** was held in the Terrace Room of the Baker Hotel in Dallas. Some of the leading metalworking and fabricating companies participated with exhibits of products and processes; 30 in all were represented.

The first of two technical sessions was presented by F. V. Lenel, professor of metallurgical engineering, Rensselaer Polytechnic Institute, who spoke on "Powder Metallurgy". The second speaker was Willis C. Brown, president of Precision Manufacturing Co., who spoke on "Shell Moulding". Mr. Brown is a graduate of the School of Science and Technology, Pratt Institute. He was district manager of Foxboro Co. in the mid-continent oil fields and organized the Spartan Aircraft Co. of Tulsa, Okla., and Southern Aircraft of Garland.

The banquet was held in the Terrace Room of the hotel and was attended by 203 members and guests. The opening address was given by Irving Comroe, chairman, and the guest speaker for the evening, Erik Jonsson, president of Texas Instruments, spoke on the "Technical Progress of Industry for the Past 30 Years."

The Southwest Metals Conference, as small as it was, had a better attendance than anticipated. The officers and committee of the North Texas Chapter would like to take this opportunity to thank each and every one who helped make the show a success. Space will be available for all of you who wish to have exhibits in the 1956 show. Information regarding the show will be mailed to A.S.M. chapter chairmen in February and every month thereafter until the final notice in October.—**Reported by Robert E. Hopper for North Texas.**

**distributes annually through chapters and by mail to secondary school students, thousands of leaflets entitled "Does Engineering Appeal to You".**

## Tells Quebec Members How Economy Was Achieved by Use of Dollar Metallurgy

Speaker: J. Gurski
*Ford Motor Co.*

J. Gurski, assistant manager, manufacturing research department, Ford Motor Co., presented a talk entitled "Dollar Metallurgy and the Automobile" at a meeting of the **Quebec Chapter.**

Mr. Gurski stressed the great importance in large-scale production of insuring every possible economy by standardization and by selection of optimum materials, stock sizes employed and manufacturing processes. Even though the savings per automobile might in a given case be only a few cents, this results on an annual production of some 2,000,000 units in very substantial savings.

Mr. Gurski described a number of interesting cases. For example, a piston pin was formerly made of tubing. A substantial saving has been affected by changing to drilled bar of "piston pin quality", and further savings resulted from slightly increasing the stock size and omitting the requirement for "piston pin quality". Finally, by adopting a cold forming process, using bar stock, two-thirds of the metal has been saved and production rates increased.

In a number of cases, such as the universal joint bearing race, induction hardening of a suitable steel has replaced carburizing with considerable economies. For the axle shaft the replacement of a quenched and tempered alloy steel by induction hardened 1038 steel has produced a shaft having better fatigue properties and capable of handling more horsepower, in addition to effecting a substantial saving.

Another instance of economy through change in specified chemical composition cited by the speaker was the case of aluminum-base die casting alloys. By increasing the permitted maximum for zinc to 2%, advantage could be taken of reclaimed metal originating in the large amount of scrap available from aircraft plants. Castability and mechanical properties were satisfactory. Mr. Gurski also outlined the savings possible by controlling the machining allowance on bar stock and by standardizing on such matters as thickness and sizes of sheets employed.—**Reported by J. E. Chard for Quebec Chapter.**

## *Compliments*

To JOHN T. BURWELL, JR., who has been named vice-president of Horizons Inc., Cleveland industrial and governmental research organization. Dr. Burwell edited the A.S.M. book "Mechanical Wear".

♦ ♦ ♦

To WILLIAM E. MAHIN, who has announced his retirement as vice-president and director of research, Hunter Engineering Co. Mr. and Mrs. Mahin are now establishing a new type of management consulting service to provide the benefit of a background of experience in research and development management as an advisory service to the metallurgical industry.

♦ ♦ ♦

To EDWARD C. KNUTH, member of the Cleveland Chapter since 1925, on his appointment as Cleveland's finance director. Mr. Knuth, assistant vice-president of the St. Clair Savings & Loan Co., was formerly a research and development engineer, plant metallurgist and plant superintendent at Cleveland Graphite Bronze Co. He received his B.S. and M.S. degrees in metallurgy from Case Institute of Technology, and a law degree from Cleveland Marshall Law School. A son, Edward, Jr., is a metallurgist with the Tapco Division, Thompson Products, Inc.

♦ ♦ ♦

To OWEN W. ELLIS, on being made a Fellow in the American Society of Mechanical Engineers. Dr. Ellis, a member of the Ontario Chapter, is director of the department of engineering and metallurgy at the Ontario Research Foundation.

**is the largest publisher of books for the metals industry in the world.**

## Tells How Theory of Metal Cutting Is Related to Practice at Pittsburgh

Speaker: Kenneth J. Trigger
*University of Illinois*

At a meeting of the **Pittsburgh Chapter**, Kenneth J. Trigger, professor of mechanical engineering, University of Illinois, presented a talk on the "Fundamentals of Metal Cutting".

When cutting metals, variables of heat, temperature and heat-temperature distribution are encountered. The heat generated in any machining operation is related to both the speed of metal removal and the force necessary to shear the chip from the work. Because most of this heat is carried away in the chip, an increase in cutting speed causes a relatively minor increase in the heat effect on the tool. Unfortunately, the small part of the total heat generated that is transmitted to the cutting tool is not distributed uniformly but is usually concentrated in the surface layers. It is this poor heat distribution, combined with abrasion of chip on tool, that causes cratering.

Professor Trigger described some results of cratering studies of metals having low shear strengths and high thermal conductivity. Using high speed steel or carbide tools at the highest cutting speeds available, he was unable to produce cratering when machining electrolytic copper.

Stressing the practical application of the results of his study, Prof. Trigger urged everyone doing machining to give some thought to the conditions that will give the best combination of metal removal, tool wear and power requirements. Through proper balance of feed and speed, up to 23% increase in the amount of metal removed can be obtained with no decrease in tool life.—**Reported by H. W. Paxton for Pittsburgh Chapter.**

## Technical Aspects of T-1 Steel Given at Buffalo

Speaker: Richard Manning
*U. S. Steel Corp.*

The development of "T-1" steel, a low-alloy constructional steel, was based on hardenability and isothermal transformation research. An excellent service history has proved the soundness of this research and established the superiority of T-1 steel over competitive materials. "Technical Aspects of T-1's Development" were presented to the **Buffalo Chapter** by Richard D. Manning, chief, bar, plate and forged products division, Applied Research Laboratory, United States Steel Corp., at a recent meeting.

T-1 fills a demand for a constructional steel having high toughness and good strength. Since a tempered martensite structure is known to be one of the toughest, it was decided that T-1 should be able to harden to 95% martensite at the center of 2 in. plates during a water quench. Full use was made of data on the effect of alloying elements on hardenability to arrive at that combination which would have the desired effect and still be most economical. Boron is one of the principal elements added to increase hardenability.

After water quenching, T-1 is tempered at a temperature just below the lower critical. In order to combine high strength with the toughness resulting from this heat treatment, vanadium was added to retard softening during tempering. The result was a steel which possessed strength greater than most constructional steels and had an impact transition temperature, as measured by Charpy keyhole specimens, in the neighborhood of −200° F.

Susceptibility to strain aging was determined by impact testing material which had been cold rolled and aged under various conditions. Transition temperature was raised only slightly.

Carbon content was kept below 0.20% to minimize weld cracking. T-1 steel has joint efficiencies over 90% when welded with low-hydrogen lime-coated electrodes.

The concept of pearlite hardenability and how it affects the development of new constructional steels, were also discussed by Mr. Manning.—**Reported by A. E. Leach for Buffalo Chapter.**

## *New Haven Completes Education Series*

*Members of the Panel Which Was Featured at the Last of a Series of Lectures on the "Heat Treatment of Metals" Held by the New Haven Chapter Included, From Left: M. J. Weldon, H. Ashley, J. Nauss and John M. Quinn*

The final session in the 1955-1956 series of educational lectures on the "Heat Treatment of Ferrous and Nonferrous Metals", sponsored by the **New Haven Chapter** was in the form of a panel discussion. Each of the four panel members opened the discussion by giving a brief talk, reviewing the highlights of the previous lectures and pointing out interesting practical applications in industry.

The panel members were then presented with a series of written questions, submitted by the audience, which covered a wide field of interest. The session concluded with additional questions from the floor.

The panel was composed of the following men: A. Phillips, professor, Yale University; M. J. Weldon, Northeastern Steel Corp.; H. Ashley, Chase Brass & Copper Co.; and J. Nauss, Bridgeport Brass Co., Aluminum Division.—**Reported by John M. Quinn for New Haven Chapter.**

## Physical Metallurgy Research With Radioactive Tracers Discussed at Ottawa Valley

Speaker: W. C. Winegard
*University of Toronto*

"The Use of Radioactive Tracers in Physical Metallurgy Research" was the subject of a talk given by W. C. Winegard, professor, department of metallurgical engineering, University of Toronto, at a meeting held recently by the **Ottawa Valley Chapter.**

Dr. Winegard discussed the three types of radiation and their characteristics with regard to isotope use. Some of the isotopes which are readily available and suitable for metallurgical research are phosphorus, tin and lead. The choice of an isotope for a particular purpose was illustrated with examples such as tin in steel, phosphorus in steel, control of processes and segregation.

Dr. Winegard discussed methods of measurement of radioactivity such as counters and autoradiography. Types of film emulsions discussed were nuclear track plates and X-ray films. The type of film used depended on the degree of resolution desired, and, in order to get resolution, the exposure time was critical.

Some examples were illustrated where radioactive tracers have been and will be useful. These included segregation during solidification, corrugations, inverse segregation, grain boundary and surface segregation.—**Reported by D. A. Scott for Ottawa Valley Chapter.**

## *Outlines Fundamentals of Corrosion*

*Shown Delivering a Coffee Talk on the "Odds of Living" to the Northeast Pennsylvania Chapter Is C. Larson of the United States Hoffman Machinery Corp. Seated at left is technical speaker, W. Z. Friend, International Nickel Co., who gave a talk on "Corrosion Fundamentals"*

Speaker: W. Z. Friend
*International Nickel Co., Inc.*

W. Z. Friend, head of the corrosion engineering section, development and research division, International Nickel Co., Inc., recently addressed the **Northeast Pennsylvania Chapter** on "Corrosion Fundamentals".

The speaker stated that metallic corrosion is an electrochemical process brought about by potential differences between the corroding and the noncorroding metal areas. These potential differences are classed into three groups: those associated with the metal itself; those associated with the metal surface; those associated with the corrosive medium.

Conditions within the first group which create potential differences include variations in microscopic composition brought about by phases, impurities, precipitates and grain boundaries. As an example of this group, Mr. Friend pointed out that graphite and cementite are cathodic to ferrite in cast iron which causes graphitic corrosion of the iron. Potential differences are also caused by variations in grain size and grain orientation.

To illustrate conditions within the second group, the speaker stated that scratches and abrasions as well as cut edges change potentials. Preexposure to some environments can either build up or break down protective film formations. Plastic deformation and even shape can result in different potential values.

Within the third group of reasons for potential differences is included heterogeneities in the corrosive medium which change potentials in homogeneous metals. Metal-ion concentration cells may set up with corrosion taking place in the area of lower concentration. This form of cell is most active in metals containing appreciable amounts of copper. Oxygen-concentration cells can also be formed as a result of differential agitation with corrosion taking place at low oxygen concentration areas.

Also included within this last group of causes for differences in potentials are the erosion of protective film formations, differential heating or lighting and stray electrical currents. Many of these points were illustrated with lantern slides.

The speaker stated that the driving force of metallic corrosion is the potential difference and that the rate of corrosion is governed by current density. To illustrate how current density is controlled by electrode areas, Mr. Friend showed slides of corrosion on bimetallic structures in which an increase in area of the anodic metal was seen to decrease the corrosion rate.

The principles of polarization and its effect on reducing current density and corrosion rate were discussed. The role played by inhibitors in increasing polarization of either the cathode or the anode was also included in the discussion.

In conclusion, the speaker outlined the principles of cathodic protection employing either induced currents or less noble auxiliary anodes.—**Reported by A. J. Babecki for the Northeast Pennsylvania Chapter.**

## Developments and Future Of Alloy Steels Discussed

Speaker: Walter Crafts
*Electro Metallurgical Co.*

At a meeting of the **Chattanooga Chapter,** Walter Crafts, associate director of research, Metals Research Laboratories, Electro Metallurgical Co., and A.S.M. trustee, reported on the present plans and accomplishments in training courses, cooperation with metallurgical programs of the universities, new headquarters, and other efforts of the Society to make A.S.M. a leader in aiding metallurgical training in this country. He then gave an account of his recent trip to the metallurgical centers of Great Britain and the Continent in connection with the Joint Metallurgical Societies meeting in Europe.

Mr. Craft's technical subject was "Recent Developments in Alloy Steels". The demand for steels in this country will continue to rise until, by 1975, demand for metals will have increased by 90% of today's demands. Most of this will be supplied by steel and cast iron, but new metals will be used in increased amounts, with aluminum demand increasing four-fold. Power plants with high temperatures and pressures, nuclear reactors, chemical industries, combustion and jet engines will all call for properties in metals not required up to now. Much work needs to be done by metallurgists in the field of alloys capable of withstanding these temperatures and stresses.

With the increasing demand the supply will increase until, by 1980, industry will be producing 200 million tons a year with alloys making up 18% of this and stainless 2%. This increase in demand and supply will call for more and more of the elements which should be conserved for those uses where no cheaper, more available substitute can be had. Already we have learned the basic laws of substituting elements to give properties given by chromium, nickel and molybdenum, and the substitution of other elements has reduced their use in less critical uses. Besides substituting elements, new processes for making steel, such as vacuum melting, give steel with high-fatigue strength and long service life. Better design can make possible the use of lower alloy steels. Nitrogen has been successfully introduced as an alloying element to give high-temperature strength. Mr. Crafts summed up the trend in steels as a continuing effort to substitute other elements for nickel where supply will only go so far and which must be conserved for the critical uses that require nickel.—**Reported by J. H. McMinn for Chattanooga.**

# A.S.M. Review of Current Metal Literature

***An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month***

*Prepared by the Technical Information Division of Battelle Memorial Institute, Columbus, Ohio*

## A General Metallurgical

**1-A. The Tin Research Institute.** E. S. Hedges. *Laboratory Practice*, v. 4, Oct. 1955, p. 422-427.

Locates divisions and laboratories throughout the world and explains some of work done to develop consumption. Photographs. (A9, T general, Sn)

**2-A. Etruscan Metallurgy.** Aldo Neppi Modona. *Scientific American*, v. 193, Nov. 1955, p. 90-94, 96, 98.

Archaeological studies to determine composition and properties of ancient bronze and other ancient metal articles. Photographs, map. (A2, Cu)

**3-A. (German.) The Light Metals in Competition With Steel.** Paul Brenner. *Stahl und Eisen*, v. 75, no. 21, Oct. 20, 1955, p. 1364-1375.

Compares physical, mechanical and chemical characteristics, uses and methods of joining. Graphs, tables, diagrams, photographs. (A general, EG-a, ST)

**4-A. Safety in Foundries.** C. Starkey. *Machinery Lloyd (Overseas Ed.)*, v. 27, Nov. 5, 1955, p. 87-89.

Ways to prevent dermatitis. (A7, E general)

**5-A. Instrumentation in the Disposal of Finishing Wastes.** A. Linford. *Electroplating and Metal Finishing*, v. 8, Nov. 1955, p. 384-388.

Fundamental problems connected with the disposal and treatment of effluents. Methods for controlling rate of flow and pH of the effluent. Diagram, photographs. (A8, L general)

**6-A. Ion Exchange Materials in the Metallurgical Industries.** T. R. E. Kressman. *Institute of Metal Finishing, Transactions*, v. 30, 1954, p. 87-94.

Modern ion exchange resins are suitable for use in the metallurgical industries for the removal of cations from chromic acid anodizing baths, for the removal of iron from phosphoric acid pickling baths and for the removal of the metals and chromic acid from plating and anodizing waste waters. 5 ref. (A8, L17, L19)

**7-A. ODM to Continue to Defer Stockpile Shipments of Certain Metals to Help Domestic Consumers.** Arthur S. Flemming. *Metals (Daily Metal Reporter Monthly Supplement)*, v. 26, Nov. 1955, p. 7-8, 11.

Seventy-five materials valued at $9.6 billion are now being stockpiled. Once materials are stockpiled they cannot enter the civilian market without Presidential proclamation. (A4)

**8-A. Doubts Die Casters' Aluminum Needs in 1956-57 Can Be Met Under Present Marketing Conditions.** David Laine. *Metals (Daily Metal Reporter Monthly Supplement)*, v. 26, Nov. 1955, p. 9-10.

Supply shortage of aluminum ingot is foreseen in 1957. Consumption in 1955 will be 400-million lb. with 450-million lb. required in 1956. (A4, E13, Al)

**9-A. A Dictionary of Metallurgy.** A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging*, v. 22, Nov. 1955, p. 465-472.

Defines "reversed bronze" through "roentgen." Diagrams, graphs. (To be continued.) (A10)

**10-A. Life Begins at Forty.** Leland I. Doan. *Modern Metals*, v. 11, Nov. 1955, p. 88-91.

The president of Dow Chemical Co. predicts a bright future for magnesium. He cites technical gains, big civilian uses, availability of the metal. (A4, Mg)

**11-A. Aluminum Shortage Until '57.** *Steel*, v. 137, Nov. 28, 1955, p. 68.

Comparison of projected requirements and production capacity. Photograph. (A4, Al)

**12-A. Western Steel Needs Rise.** *Steel*, v. 137, Nov. 28, 1955, p. 71.

Survey of Western steel markets for the years 1951 to 1954. Table. (A4, ST)

**13-A. Economics of Oxygen Steelmaking.** *Steel*, v. 137, Nov. 21, 1955, p. 100, 103, 106.

Compares costs of oxygen and openhearth steel making. Photographs. (A4, D2, D8)

**14-A. Controlling Climate Effects to Meet Industry Needs.** Lawrence E. Doyle and Ronald D. Lemon. *Tool Engineer*, v. 35, Dec. 1955, p. 113-120.

Answers to climatic problems which could arise in metalworking plants. Tables, graph, maps, 1 ref. (A5)

**15-A. United Nations Quarterly Bulletin of Steel Statistics for Europe,** v. 6, no. 3, Sept. 1955, 123 p.

Tables of production, consumption of raw materials, foreign trade and deliveries of steel to industries for iron products, iron ore, coke, pig iron and crude steel. Tables. (A4, Fe, ST)

*The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.*

**16-A. Industrial Hygiene and Safety.** E. C. Barnes. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 733-741.

Explosion hazards, shipment techniques, toxicity. 15 ref. (A7, A5, Zr)

**17-A. (German.) Steel Industry. Iron Production and Steel Manufacturing.** G. Bulle. *VDI Zeitschrift*, v. 97, no. 31, Nov. 1, 1955, p. 1111-1121.

Annual review of iron and steel production in U.S.A. and Germany, mentioning innovations in the fields. Tables, graphs, diagrams, photograph. 18 ref. (A4, D general, Fe, ST)

**18-A. (German.) Rolling Mills.** H. Sedlaczek. *VDI Zeitschrift*, v. 97, no. 31, Nov. 1, 1955, p. 1121-1125.

Review of world production of rolling mills with corresponding figures and references. 100 ref. (A4, F23, ST)

**19-A. (Book.) Chemical Trade Names and Commercial Synonyms.** William Haynes. 2nd Rev. Ed. 466 p. 1955. D. Van Nostrand Co., 120 Alexander St., Princeton, N. J. $8.00.

Contains a key to manufacturers (with addresses), and trade names and symbols defined by their composition and uses. (A10)

**20-A. (Book.) Metals Handbook—1955 Supplement.** Taylor Lyman, editor. 208 p. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $6.00.

First published and abstracted as the Aug. 1955 issue of *Metal Progress*. Covers design and applications, processing and fabrication, and testing and inspection. (A general)

**21-A. (Book.) Industrial & Manufacturing Chemistry. Pt. II. Inorganic.** Geoffrey Martin. 6th Ed. (Revised by Wilfrid Francis.) v. II. 491 p. 1955. Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y.

Brief review of manufacture and processing of chemicals, cements, ceramic ware, abrasives, and nonferrous metals. Pertinent papers abstracted individually. (A general, EG-a)

**22-A. (Book.) Problems and Control of Air Pollution.** Frederick S. Mallette, editor. 272 p. 1955. Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y.

Comprehensive treatment of the aspects which contribute to the lack of knowledge relating to biological and health implications, meteorological problems, control patterns and research, and pollutant identification and distribution; current developments; treatment and recovery of sulfur dioxide; pollution problems and experiences abroad. (A7, A8)

**23-A. (Book.) Safety in Industry.** D. I. Macfarlane. 71 p. 1955. Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. $6.00.

Dust and fume control, rotating machinery and press guards, derma-

titis control, eye protection, ionizing radiations, protective clothing, lighting, and flooring are discussed as they pertain to personnel protection. (A7)

## B

## Raw Materials and Ore Preparation

**1-B. Metallurgical Coke in Canada.** J. R. Wallace, E. P. Duchemin and William Snow. *Canadian Mining and Metallurgical Bulletin,* v. 48, no. 522, Oct. 1955, p. 654-662; *Canadian Institute of Mining and Metallurgy, Transactions,* v. 58, 1955, p. 384-392.

Deals specifically with the coal, coke and smelting problems in Nova Scotia. Map, tables, graphs, diagrams, photographs. 9 ref. (B22)

**2-B.** (French.) **The Mineral Resources of Egypt.** Mohammed Ezz El-Din El-Zoghby. *Revue de l'industrie minérale,* v. 36, no. 630, Oct. 1955, p. 1072-1082.

General review of mineral deposits and developmental possibilities. Map. (B10, Au, Cu, Zn, Pb, Mn, Fe)

**3-B.** (German.) **The Use of Fuel Oil in an Integrated Steelworks.** Hans Weineck. *Stahl und Eisen,* v. 75, no. 21, Oct. 20, 1955, p. 1375-1383.

Consequence of coke oven gas shortage, use of oil is explained. Diagrams, graphs, photographs, tables. 6 ref. (B18, ST)

**4-B. How Manganese, Inc., Upgrades Complex Three Kids Ore.** J. B. Huttl. *Engineering and Mining Journal,* v. 156, Nov. 1955, p. 88-93.

Manganese, Inc.'s plant near Henderson, Nev., upgrades a complex manganese ore by flotation and produces high-grade nodules from those concentrates. Flowsheet, photographs. (B14, Mn)

**5-B. How Synthetic Flocculants Help the Mill Operator.** D. J. Pye. *Engineering and Mining Journal,* v. 156, Nov. 1955, p. 94-96.

Sparan 2610 decreases necessity of large settling areas and heavy filtration equipment. Four case histories. Graphs, table, diagram. (B14)

**6-B. Effect of Sinter Mix Composition and Additives on the Quality of Blast Furnace Sinter.** E. C. Rudolphy, C. W. Boquist and D. J. Carney. *Journal of Metals,* v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 203, Nov. 1955, p. 1179-1189.

Determines changes in strength, bulk density, chemical composition, microstructure and feed permeability. Tables, graphs, micrographs, photographs. 14 ref. (B16, D1, Fe)

**7-B. Production and Purification of $TiCl_4$.** L. W. Rowe and W. R. Opie. *Journal of Metals,* v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 203, Nov. 1955, p. 1189-1193.

Brief history, classifies chlorinator feed materials, discusses thermodynamics and kinetics of production, outlines problems. Graphs, tables. 23 ref. (B14, C4, Ti)

**8-B. History and Trends of the Uranium Plant Flowsheet.** A. Q. Lundquist and J. L. Lake. *Mining Congress Journal,* v. 41, Nov. 1955, p. 37-42.

Extraction of uranium dating back to 1900, traced through all its stages to the most modern plants. Photographs, flowsheets, table. (B14, U)

**9-B. Iron Ores: Some Considerations on Their Availability, Properties, and Usage.** D. Joyce and B. Marsden. *Canadian Mining and Metallurgical Bulletin,* v. 48, no. 523, Nov. 1955, p. 727-732; *Canadian Institute of Mining and Metallurgy, Transactions,* v. 58, 1955, p. 427-432.

Includes graph, tables. 6 ref. (B general, Fe)

**10-B. The Industry of Aluminium Compounds.** Geoffrey Martin. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 49-58.

Manufacture, properties, uses of alumina, aluminum hydroxide and aluminum sulfate. Tables. 10 ref. (B general, C general, Al)

**11-B.** (German.) **Investigations on the Properties of Blast Furnace Coke.** Hermann Schenck and Hans Esch. *Stahl und Eisen,* v. 75, No. 22, Nov. 3, 1955, p. 1421-1425.

Mechanical, thermal, chemical attack to be endured by the coke; effect of a pure compression load with different initial particle sizes and loads; determination of strength by means of the portion of the coke remaining undeteriorated and of the work required for its crushing. Graphs. 26 ref. (B18, D1)

**12-B.** (Russian.) **Conditions for Accelerating the Sintering of Bessemer and Openhearth Manganese Agglomerates.** T. A. Kramnik and N. I. Nechesova. *Stal',* v. 15, no. 10, Oct. 1955, p. 880-886.

Coke fines and culm used as fuel to speed up rate of agglomeration, introduction of lime into the charge, optimum recovery quantities. Effectiveness of method decreases with any sizable additions of coarse-grained recovered material, which tends to segregate into the lower strata of the charge. Tables, graphs. (B16, Fe)

**13-B.** (Russian.) **New Methods of Testing Mechanical Properties of an Agglomerate.** N. Z. Plotkin, G. G. Oreshkin and A. K. Rudkov. *Stal',* v. 15, no. 10, Oct. 1955, p. 887-891.

Instead of drum or barrel testing of agglomerate, a method of repeated shaking is recommended; factors considered include number of shakes, size of screen mesh, quantity and size of nodules on screen; relation of composition and mechanical properties of agglomerate to oxygen content in charge. Diagrams, tables, photograph, graphs. (B16, Q general, Fe)

**14-B.** (Book.) **Metallurgical Progress-2.** 71 p. 1955. Philosophical Library, 15th East 40th St., New York 16, N. Y.

Papers on preparation of ores, electric steel production, and nonmetallic inclusions. (B general, D5, D9)

## C

## Nonferrous Extraction and Refining

**1-C. Vacuum Melting Furnaces—An Interim Report.** Frank Chesnut. *Metal Progress,* v. 68, Nov. 1955, p. 118-123.

Modern induction furnaces which can make 1000-lb. ingots, and others for arc melting in vacuo such difficult metals as molybdenum and titanium. Photographs, diagram. (C25, D8, Mo, Ti)

**2-C. Titanium Plant at Boulder City, Nev.: Its Design and Operation.** C. T. Baroch, T. B. Kaczmarek, W. D. Barnes, L. W. Galloway, W. M. Mark and G. A. Lee. *U. S. Bureau of Mines, Report of Investigations* 5141, Sept. 1955, 76 p.

Process based on reduction of titanium tetrachloride with magnesium. Tables, diagrams, photographs. 17 ref. (C4, Ti)

**3-C.** (Russian.) **Calculation of the Solidification Kinetics of a Metal Ingot at Various Temperature Conditions on Its Surface.** V. T. Borisov, B. Ia. Liubov and D. E. Temkin. *Doklady akademii nauk SSSR,* v. 104, no. 2, Sept. 11, 1955, p. 223-226.

Solution for the displacement of the recrystallization front in a solidifying ingot. Graphs. 3 ref. (C5, D9, N12)

**4-C. Recovery of Metallic Zinc From Dross and Skimmings.** G. Lorber. *Henry Brutcher Translation No.* 3413, 6 p. (From *Metallwissenschaften und technik,* v. 5, nos. 13-14, 1951, p. 291-292.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 107-C, 1951. (C22, A8, Zn)

**5-C.** (Hungarian.) **Experiences With Retorts in Silicon-Thermal Magnesium Metallurgy.** Lajos Pilissy. *Kohaszati lapok,* v. 10, no. 10, Oct. 1955, p. 454-457.

Review of various methods on basis of literature. Outline of Hungarian experiments necessary for determinating proper method and alloy to be used. Tables, graph, diagram. 4 ref. (C21, Mg)

**6-C. Induction-Melted Zirconium and Zirconium Alloys.** H. A. Saller, R. F. Dickerson and E. L. Foster, Jr. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-908, Mar. 1954, 38 p.

Melting and fabrication techniques; data on hardness, electrical resistivity, corrosion behavior in steam and water, drawability. Photographs, tables, graphs. 8 ref. (C21, Q29, R4, G4, P15, Zr)

**7-C. Ultra-Pure Solids for Electronics.** Max M. Grandsen. *Canadian Chemical Processing,* v. 39, Nov., 1955, p. 43-46.

Processing germanium for making a transistor. Photographs, graph. 3 ref. (C general, T1, Ge)

**8-C. Preparation of High-Purity Thorium by the Iodide Process.** N. D. Veigel, E. M. Sherwood and I. E. Campbell. *Electrochemical Society, Journal,* v. 102, Dec. 1955, p. 687-689.

Describes van Arkel-de Boer process. Substantial reduction in the nonmetallic content over that of the feed material was obtained. Determination of optimum deposition conditions. Photographs, tables. (C4, Th)

**9-C. Impurties in Copper-Base Alloys.** Frank J. Versagi. *Foundry,* v. 83, Dec. 1955, p. 98-107.

Survey of effects, detection and removal of aluminum, antimony, iron, lead, nickel, phosphorus, manganese, silicon, sulphur, tin, zinc and gases. Tables, photographs. 47 ref. (C general, Cu)

**10-C. INCO Develops New Oxygen Flash Smelting Process to Treat Copper Sulphide Concentrates.** *INCO,* v. 26, no. 6, Oct. 1955, p. 2-5.

Furnace gases recovered for use in making liquid sulfur dioxide and sulfuric acid. Photographs. (C21, Cu)

**11-C. Conversion of Zirconium Sulfates to Anhydrous Zirconium Tetrafluoride.** G. H. Beyer, E. L. Koerner and E. H. Olson. *Iowa State College, Ames Laboratory (U. S. Atomic Energy Commission),* ISC-634, Aug. 1955, 25 p.

Production of zirconium tetrafluoride suitable for making soft zir-

conium metal. Quality of the zirconium metal was dependent upon the purity of the fluoride employed in the reduction. Graphs, table, diagram, flowsheets. 13 ref. (C4, Zr)

**12-C. Melting of High Purity Uranium.** Bernhard Blumenthal. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1199-1205.

High-purity electrolytic uranium crystals converted into sound ingots by melting in a high vacuum. Directional solidification results in better than 99.993 weight % purity. Micrographs, diagrams, tables. 13 ref. (C5, C25, U)

**13-C. Extraction of Lithium From Its Ores.** Reuben B. Ellestad and Fremont F. Clarke. *Mining Engineering*, v. 7, Nov. 1955, p. 1045-1047.

Lithium chemical plant extraction methods discussed with reference to base exchange with alkali sulphates; processing based on roasting with lime; miscellaneous methods; application of the Lithium Corp. process to extraction of lithium from run-of-mine, low-grade spodumene ore or concentrates. 16 ref. (C general, Li)

**14-C. Meeting the Requirements for Pure Electronic Metals.** Robert J. Anderson. *Mining World*, v. 17, Dec. 1955, p. 61-63.

Survey of various methods of purifying metals. Photographs. 2 ref. (C general)

**15-C. Separating and Purifying Reactor Fuel From Uranium-Ore Concentrates.** Wilbur E. Kelley. *Nucleonics*, v. 13, Nov. 1955, p. 68-71.

Present and past methods, possible future improvements in feed materials operations (processing high-grade ores and ore concentrates to produce metallic uranium or uranium fluoride gas). Diagrams. 5 ref. (C general, U)

**16-C. (English.) Zone-Melting Processes Under Influence of the Atmosphere.** J. van den Boomgaard. *Philips Research Reports*, v. 10, Oct. 1955, p. 319-336.

Shows that it is possible to bring a volatile impurity element homogeneously into an ingot by means of zone melting under a constant vapor pressure of that element. Diagrams, graphs. 6 ref. (C5)

**17-C. Aluminothermics: "Thermit" and Its Applications.** H. Stanley Redgrove. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 67-76a.

Preparation of metals and alloys by Goldschmidt reaction, uses of "Thermit" as heating agent and source of molten steel, and use of "Thermit" slag. Tables. 8 ref. (C26)

**18-C. Zirconium Production Methods.** S. M. Shelton, editor. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 59-134.

Thermodynamic properties of zirconium compounds, Kroll and other processes, hafnium removal. Diagrams, tables, photograph, graph. 145 ref. (C general, P12, Zr)

**19-C. Iodide-Decomposition Process for Production of Zirconium.** Z. M. Shapiro. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 135-215.

Equipment and methods for production of ductile metal from Kroll sponge. Diagrams, photographs, graphs, tables. 56 ref. (C4, Zr)

**20-C. Melting and Shaping of Zirconium and Its Alloys.** R. B. Gordon, editor. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 216-306.

Arc, induction, resistance, drip and autocrucible melting. Fabrication methods including rolling, extrusion, swaging, drawing, powder metallurgy. Photographs, diagrams, graphs, micrographs, tables. 105 ref. (C21, F general, H general, Zr)

## D
## Ferrous Reduction and Refining

**1-D. Mexico's Most Modern and Largest Steel Plant.** Gordon Bennett. *Blast Furnace and Steel Plant*, v. 43, Nov. 1955, p. 1267-1270, 1272, 1281.

Facilities, including power plant, blast furnace, openhearth and hot and cold mills. Photographs. (D general, ST)

**2-D. Casting Pit Practice.** G. Reginald Bashforth. *British Steelmaker*, v. 21, Oct. 1955, p. 316-320.

Discusses change from liquid to solid, solution required, reaction products, tap holes, ladle linings, center feed, manganese difficulties, successful tundishing and splash control. Photographs, diagrams. 7 ref. (D9, ST)

**3-D. When an Atomic Man Pokes Into a Steel Mill.** *Business Week*, 1955, no. 1365, Oct. 29, p. 44-46, 52, 54.

Since July 1954, one steel company has been researching into possible uses of atomic energy in producing steel. (D general, ST)

**4-D. Out Goes Hydrogen.** *Steel*, v. 137, Nov. 14, 1955, p. 120, 123.

Process used in Germany for degassing tonnage steel is being introduced to U. S. mills; shows three variations. Photograph, diagrams, table. (D general, ST)

**5-D. (Czech.) Contribution to the Diagram of the Specific Coke Consumption in Blast Furnaces.** Jindrich Sarek. *Hutnické listy*, v. 10, no. 10, Oct. 1955, p. 577-580.

Multiplying the amount of slag by the amount of coke necessary for the reduction and melting of one ton of produced pig iron, figures for a diagram of specific coke consumption can be obtained. Diagrams. 7 ref. (D1, Fe)

**6-D. (Czech.) The Effect of the Chemical and Mineralogical Composition of Talbot Slags on Their Solubility.** Theodor Myslivec, A. Waleczek and P. Kuhn. *Hutnické listy*, v. 10, no. 10, Oct. 1955, p. 605-609.

Chemical conditions for the formation of soluble phosphorus slags produced as a byproduct in the production of steel in 250-ton tilting openhearth furnaces and used for producing Thomas powder. Compounds were determined which cause a substantial decrease of the solubility of phosphorus slags. Graphs, micrographs. 15 ref. (D2, B21, ST)

**7-D. (French.) The Problem of Red Smokes. A Pilot Plant for the Precipitation of Iron Oxide Dusts.** P. Leroy and L. Septier. *Institut de recherches de la sidérurgie, Publications*, ser. A. no. 102, July 1955, 37 p.

Description and operation of the pilot plant, characteristics of dusts precipitated, possibilities of using these dusts. Diagrams, photographs, graphs, tables. (D1, Fe)

**8-D. (German.) Special Questions of Blast Air Supply in Smelting Works.** Hans Pötzschner and Joachim Tischendorf. *Metallurgie*, v. 5, no. 9, Sept. 1955, p. 272-280.

Methods of recording which deal with characteristics of conduits and shaft furnaces. Graphs, diagrams, tables. 4 ref. (D1)

**9-D. Bottom Materials and Bottom Maintenance.** H. C. Bigge. *Electric Furnace Steel Conference, Proceedings*, v. 12 1954, p. 46-56.

A 96% magnesium oxide rammed bottom installed by the coke process, with holes drilled in the shell, makes the most efficient installation to date. Washing of the bottom periodically lessens contamination and produces cleaner steel. Tables, photographs, diagram. 5 ref. (D5, ST)

**10-D. Side Walls and Side-Wall Maintenance.** J. E. Harrod. *Electric Furnace Steel Conference, Proceedings* v. 12, 1954, p. 64-67.

Side wall life can be extended by careful scheduling of alloy steel heats with stainless steel heats combined with prompt maintenance practice. (D5, AY, SS)

**11-D. Side Walls and Their Maintenance.** R. J. McCurdy. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 67-69; disc., p. 69-74.

Furnace design and matching of electrodes to avoid hot spots; patching practice; new Cohart refractory. Tables, photographs. (D5, ST)

**12-D. Construction and Maintenance of Roofs on Large Top-Charged Electric Furnaces.** K. L. Grant. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 74-81; disc., p. 81-84.

Design of roof rings, roofs and refractories and their maintenance. A roof, 20 ft. in diameter, weighing 37 tons, for an 85-ton furnace, discussed. Photographs. (D5, ST)

**13-D. Effect of Intermittent Operations on Refractories.** A. K. Blough and D. M. Schrader. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 84-86.

Short period shutdowns favor small furnace performance, but large (50-ton) furnace performance is depressed. Some results cannot be explained. Graphs. (D5, ST)

**14-D. New Developments in Exothermic Hot Topping of Ingots.** Michael Bock, II. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 163-169; disc., 169-173.

Aluminum-iron oxide hot topping and exothermic mold mixtures used to control ingot pipes and flaws. Photographs, table, graph. (D9, SS, ST)

**15-D. Addition of Special Minor Elements to Electric Furnace Heats.** Charles W. Sherman. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 182-183.

Minor elements and techniques for their inclusion. (D5, ST)

**16-D. Use of High-Alumina Brick in the Single-Slag Basic Practice.** Vincent E. Belusko. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 184-192; disc., p. 192-193.

Change in design to a higher roof permits high-alumina brick to be used for a two to three-fold increase in refractory life. Table, photographs. (D5, ST)

**17-D. Ladle Lining and Practice for Stainless Steel.** H. R. Lewis. *Electric Furnace Steel Conference, Proceedings*, v. 12, 1954, p. 204-205; disc., p. 205-207.

Design of a teapot ladle for a 5000-lb. charge of metal at 3200 to 3300° F. The teapot ladle is preferred here. (D9, SS, AY)

**18-D. Efficiencies of Electric Furnaces Can Be Increased by Using Higher Voltages.** E. L. French. *Journal of Metals,* v. 7, Nov. 1955, p. 1169-1171.

New design, advantages of higher voltages in larger corbide and ferroalloy furnaces. Graphs. (D5, C-n, Fe-n)

**19-D. Oxygen Refining of Stainless Steels in Electric Arc Furnace.** F. Ciess. *Henry Brutcher Translation No.* 3104, 23 p. (Condensed from *Radex Rundschau,* 1951, no. 8, p. 341-354.) Henry Brutcher, Altadena, Calif.

Physical chemistry of the oxygen treatment of 18-8 and 19-10-2 stainless scrap in the basic arc furnace. Effect of amount of chromium in charge and of furnace size upon chromium recovery. Tables, graphs, photographs, micrographs. 21 ref. (D5, SS, Cr)

**20-D.** (Russian.) **Thermotechnical Conditions for the Operation of Open-Hearth Furnaces Above Usual Capacities.** I. M. Koburneev. *Stal',* v. 15, no. 10, Oct. 1955, p. 895-904.

Design elements to eliminate time loss on melting operations; improvement of fuel efficiency; calculations of thermal resistance of bath; techniques of charging furnace; charge melting conditions. Graphs, tables, diagram. 9 ref. (D2, CI)

**21-D.** (Russian.) **Use of Protective Heat Resistant Section in Front of Acicular Recuperator.** B. L. Poletaev and A. A. Sorokin. *Stal',* v. 15, no. 10, Oct. 1955, p. 945-947.

Operational efficiency and service life of these recuperators can be increased by setting protective sections of heat resistant piping in front of them to bear the brunt of thermal shocks inevitably present in heating furnaces of high thermal capacity. Diagrams, tables. 2 ref. (D general)

**22-D. Sulphur Distribution Between Flame and Slag in the Open Hearth Furnace.** George St. Pierre. *Industrial Heating,* v. 22, Nov. 1955, p. 2306 + 5 pages.

Chemical reactions occurring between sulfur-bearing gases and slags. Graphs, tables. 7 ref. (D2)

**23-D. New Hot Tops Save Metal, Make Sounder Ingots.** H. D. Shephard. *Iron Age,* v. 176, Nov. 24, 1955, p. 79-82.

New moldable, exothermic material for hot top lining. Photographs, diagrams. (D9)

**24-D. Jones & Laughlin. . .Aliquippa Works.** T. J. Ess. *Iron and Steel Engineer,* v. 32, Nov. 1955, p. 74-103.

Plant operation and production methods. Photographs, tables, diagrams. (D general, A5, Fe, ST)

**25-D. Electric Smelting of Titaniferous Ironsands at Onekaka.** T. Marshall and D. S. Nicholson. *New Zealand Journal of Science and Technology,* v. 37, sec. B, no. 2, Sept. 1955, p. 201-220.

Theoretical aspects. Iron sands could be smelted in a continuously operated electric furnace. Diagram, tables, graphs. 9 ref. (D5, Fe)

**26-D.** (French.) **Economical Considerations of Gas Pipe Diameters Used in Blast Furnaces.** M. J. Szczeniowski. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques,* v. 12, no. 10, 1955, p. 2007-2011.

Calculations are made with respect to determining the diameter that affords the maximum economy in gas supply, its variation as a function of average flow, number of hours in service, capital investment, other factors. Graphs. (D1)

**27-D.** (German.) **Production of Pig Iron in the Electric Smelting Furnace.** Borut Marincek. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1426-1432.

Ore-reducing conditions; possibilities of reducing current and coal consumption; utilization of slag and top gas. Graphs, tables, photograph. 2 ref. (D5, D8, Fe)

**28-D.** (German.) **The Use of Oxygen for Raising the Refining Speed.** Hans Kosmider. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1433-1439.

Volume of oxygen required for the combustion and slagging of the accompanying elements of pig iron. Decarburizing rate and shortening of the refining time with openhearth melts produced by different pig iron charges, shown as dependent on the oxygen input per time unit. Graphs. (D2, Fe)

**29-D.** (German.) **Design and Equipment of Modern Stationary Open-Hearth Furnaces.** Henno-Franz Strähuber. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1439-1445.

Design details of the Maerz 150-ton furnace, covering the slag chamber doors, arrangements of measuring spots, use of immersion pyrometers, abandonment of the full-automatic reversing system of the generators, and the atomization of oil by blast furnace gas. Diagrams, photographs. 2 ref. (D2)

**30-D.** (German.) **The Use of Graphite Electrodes in Electric Arc Furnaces.** Georg Moll. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1445-1452.

Characteristics and carrying capacity of graphite electrodes; methods of locking nipple joints to avoid loosening and advantages of conical nipples; specific electrode consumption in electric steel melting; compares graphite, carbon and Söderberg electrodes. Photographs, graphs, tables, diagrams. 10 ref. (D5)

**31-D.** (Russian.) **Use of Carbon Blocks in Hearth Well and Hearth of Blast Furnaces.** I. G. Polovchenko. *Stal',* v. 15 no. 10, Oct. 1955, p. 891-894.

Because of their high thermal conductivity, carbon blocks facilitate the work and lengthen service life of the refractory lining. The use of bottom cooling of the hearth well and a deepened "dead" layer of metal is expedient in this set-up. Use of radio-active tracers for following changes in hearth lining. Diagrams, graphs, photograph. (D1, Fe)

**32-D.** (Russian.) **Determination of Time for Bessemer Converter Blow Operation to Be Stopped.** K. S. Garger and V. D. Umnov. *Stal',* v. 15, no. 10, Oct. 1955, p. 905-909.

Method for stopping blow at desired higher carbon contents is based on recording difference or ratio of currents from two photo-electric cells operating at different points in the spectrum. Graph, diagrams, circuit diagram, tables. 10 ref. (D3, ST)

**33-D.** (Book.) **Electric Furnace Steel Conference, Proceedings, (Annual Volume),** v. 12, 1954, 222 p. American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York, 18, N. Y.

Series of papers on vacuum melting, refractory and masonry, melting, ingot quality, and operations in foundry melting. (D5, D8, D9, ST)

## E
## Foundry

**1-E. Foundry Practice. X. Fettling Operations.** William H. Salmon and Eric N. Simons. *Edgar Allen News,* v. 34, Oct. 1955, p. 231-232.

Chipping, burning-off, grinding, rumbling, shot blasting and hydroblast. (To be continued.) (E24)

**2-E. Chemical Reactions in the Cupola.** G. A. H. Jungbluth and K. Stockkamp. *Foundry Trade Journal,* v. 99, Oct. 13, 1955, p. 405-411.

Experiments show effect of hot blast on combustion temperature of coke, combustion ratio, iron temperature, iron oxide and on silicon, manganese, phosphorus and sulfur content. Graphs, tables. 6 ref. (E10, Fe)

**3-E. Moulding in an Indian Foundry.** S. G. Athanikar. *Foundry Trade Journal,* v. 99, Oct. 20, 1955, p. 431-436; disc., p. 436-438.

Facilities of one company, procedures for molding four typical castings of medium-to-large weight range. Photographs, diagrams. (E19)

**4-E. Development of an Improved Method for Cupola Charging to Meet Increased Production Requirements.** Harry G. McCallum. *General Motors Engineering Journal,* v. 2, Nov.-Dec. 1955, p. 14-19.

Principle based on a delayed action electromagnetic metallic charge make-up equipment and skip charger method which has eliminated much human effort. Diagrams. (E10, CI)

**5-E. Casting Magnesium for Supersonic Aircraft.** William Helme. *Industrial Gas.* v. 34, Oct. 1955, p. 3-5.

Work of the Howard Foundry Co. of Chicago, an organization that stayed with magnesium after World War II. Photographs. (E general, Mg)

**6-E. Magnesium Progress in France.** *Light Metals,* v. 18, Oct. 1955, p. 336-337.

Capacity and foundry practices of one plant. Photographs. (E general, Mg)

**7-E. Some Factors Relating to the Effective Operation of Die Casting Dies.** H. K. Barton and L. C. Barton. *Machinery (London),* v. 87, Oct. 28, 1955, p. 1027-1034.

Die changing between shifts, preventive maintenance, inspection of sample castings and replacement parts. Graphs, table. (E13)

**8-E. Investment Castings: 4% Carbon Shot Controls Melt Chemistry.** W. F. Carn and D. F. Mika. *Modern Castings and American Foundryman,* v. 28, Nov. 1955, p. 34-35.

Shot permits closer control than other forms of melting stock and reduces amount and number of necessary additions. Table, photograph. (E15, CI)

**9-E. How to Save $½ Million.** A. J. Carah. *Modern Castings and American Foundryman,* v. 28, Nov. 1955, p. 36-40.

Premium casting replaces machined missile part. Diagrams, graphs, photographs, tables. (E11)

**10-E. Special Cupolas and Accessories.** *Modern Castings and American Foundryman,* v. 28, Nov. 1955, p. 41-46.

Developments are overcoming past deficiencies and are resolving problems created by castings buyer demands. Photographs, diagrams. (E10)

**11-E. Looking into the Heart of a Mold.** V. D. Frechette. *Modern Castings and American Foundryman,* v. 28, Nov. 1955, p. 58-62.

How polarizing and stereoscopic microscopes identify and analyze molding materials and define their textural characteristics. Diagrams, graphs, photographs. 25 ref. (E18, S11)

**12-E.** (Dutch.) **The Application of Alloyed Steel in Precision Casting.**

H. J. Meerkamp van Embden. *Metalen*, v. 10, no. 18, Sept. 30, 1955, p. 381-386.

Various casting methods, melting, risers and types of parts. Photographs. (E15, AY)

**13-E. (French.) Prerefining Cast Iron in the Ladle by Means of Pure Oxygen. Results Obtained in a Pilot Plant.** P. Leroy and L. Septier. *Institut de recherches de la sidérurgie, Publications*, ser. A, no. 101, July 1955, 175 p.

Process, variations and results of primary desiliciation of cast irons by injecting pure oxygen into the cast iron in ordinary steel mill or blast-furnace ladles. Tables, diagrams, graphs. 12 ref. (E25, D1, CI)

**14-E. (German.) Ideas for Classification of Iron-Carbon Casting Alloys.** Adelbert Wittmoser. *Giesserei*, v. 42, no. 21, Oct. 13, 1955, p. 573-580.

Necessity of establishing norms, classification of alloys with spheroidal graphite formation, related problems. Diagrams, micrographs, graphs, tables. 44 ref. (E general, S22, CI)

**15-E. (German.) Tests in Basic Cupola Furnace With Hot Blowing and Coating Coke With a Crust.** Martin Georg Frohberg and Willi Döbber. *Giesserei*, v. 42, no. 21, Oct. 13, 1955, p. 580-585.

Investigation of coating the coke with portland cement crust and its relation to desulfurization of cast iron. Diagram, graphs, photograph, tables. 22 ref. (E10, CI)

**16-E. (Japanese.) Basic Experiments in Connection With Gas-Type Casting (the $CO_2$ Process).** Kazuo Shikatori. *Metals (Japanese)*, v. 25, no. 10, Oct. 1955, p. 725-729.

Sand properties, methods of introducing gas, compression strength and gassing time, types of compacts and binder contents, molds and cores. Graphs, photographs, diagram. 10 ref. (E18, E11, CI)

**17-E. (Swedish.) Theories of Bonding Forces of Clays With Particular Reference to *p*H-Control of Molding Sands.** M. Itzel. *Gjuteriet*, v. 45, no. 9, Sept. 1955, p. 123-128.

Effect of constitution and forces acting between clay particles on properties of clays in molding sands. By *pH* control, the properties of the molding sand can be changed. Photographs, graph, diagrams. 14 ref. (E18)

**18-E. A New Coremaking Practice.** F. Brunn. *Henry Brutcher Translation No.* 3614, 11 p. (Abridged from *Metallurgie und Giessereitechnik* v. 4, no. 3, 1954, p. 113-116.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 322-E, 1954. (E19)

**19-E. Coremaking With Waterglass and Corbon Dioxide in the Gray-Iron Foundry.** F. Naumann. *Henry Brutcher Translation No.* 3615, 4 p. (Abridged from *Metallurgie und Giessereitechnik*, v. 4, no. 3, 1954, p. 116-117.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 333-E, 1954. (E21, CI)

**20-E. (Czech.) Comparative Study of Materials and Casting Methods for Piston Rings.** Vaclav Oliverius. *Slévarenstvi*, v. 3, no. 10; *Prace Ceskoslovenského vyzkumu slévarenskenho*, v. 2, no. 24, Oct. 1955 p. 161-168.

Properties and structure of various cast irons and cast steel formed by stationary and centrifugal casting. (E11, E14, Q general CI)

**21-E. (Czech.) Contribution to the Production of "Pyroferal" Castings.** Zdenek Eminger. *Slévarenstvi*, v. 3, no. 10, Oct. 1955, p. 309-317.

Melting, choice of charge, pouring, contraction, molding sands and technique, and gating systems for production of aluminum-iron alloy castings. Photographs, diagrams. (E11, Al, Fe)

**22-E. (Czech.) Foundry Mechanization in the Soviet Union.** Bonumil Hornicek. *Slévarenstvi*, v. 3, no. 10, Oct. 1955, p. 317-321.

The author, who recently visited the Soviet Union, shows examples of how even older foundries are mechanized in the Soviet Union and describes the organization of work in these factories. Diagrams. (E general, CI)

**23-E. (Czech.) Contribution to the Theory and Practice of Atmospheric Risers.** Miroslav Houst. *Slevarenstvi*, v. 3, no. 10, Oct. 1955, p. 322-324.

Processes occurring in the atmospheric riser during solidification, with special attention to the question whether the core, on heating should develop more gas and whether the gas should freely leave the riser. Diagram, photographs. 1 ref. (E22, E25)

**24-E. (Hungarian.) Centrifugal Casting of Steel.** Herbert Hartmann and Tamas Ko. *Ontöde*, v. 6, no. 10, Oct. 1955, p. 225-236.

Comparative quality of centrifugal and stationary castings. Diagrams, photographs, tables, micrographs. (E14, CI)

**25-E. Gas Porosity and Non-Metallic Inclusions in Aluminum Alloys.** Jack Morgan. *Canadian Metals*, v. 18, Nov. 1955, p. 26-28, 30.

Techniques for correcting defects in aluminum alloy castings. Photographs. (E25, Al)

**26-E. Gating and Risering of Non-Ferrous Castings.** Alan R. Moore. *Canadian Metals*, v. 18, Nov. 1955, p. 33-34, 36.

Advice on positioning, pouring, temperatures and production planning for good gating. (E22)

**27-E. Shell Moulding in Canada.** E. W. Chapman. *Canadian Metals*, v. 18, Nov. 1955, p. 39-40, 44.

Advantages and techniques of shell molding. Photographs. (E16)

**28-E. Pouring Practice in the Brass Foundry.** Harry St. John. *Foundry*, v. 83, Dec. 1955, p. 90-93.

Important factors are cleansing of molten metal, proper pouring temperature, correct care of the ladle. Photograph, diagrams. (E23, Cu)

**29-E. Small Steel Foundry Produces Specialty Castings.** Edwin Bremer. *Foundry*, v. 83, Dec. 1955, p. 94-97.

Plant layout and operating procedure of Waunakee Alloy Casting Corp., including floor plan. Photographs. (E general, CI)

**30-E. Shell Cores—Their Production and Application.** Ray Olson. *Foundry*, v. 83, Dec. 1955, p. 108-112.

Development of shell cores gives greater molding accuracy and smooth castings. Photographs. (E21, E16)

**31-E. Hot Strength of Clay-Bonded Sands.** W. B. Parkes. *Foundry*, v. 83, Dec. 1955, p. 113-119.

Properties and influence of various additives measured to test behavior of sand in the mold. Graphs, table. 5 ref. (E18)

**32-E. Patterns Cast in Epoxy Resin.** D. B. Orr. *Foundry Trade Journal*, v. 99, Nov. 10, 1955, p. 531-536.

Details of the adaptation of a simple process to meet diverse pattern requirements, using a material that presents no shrinkage problems. Photographs. (E17)

**33-E. A Jobbing Investment Foundry in South Africa.** J. Steele. *Foundry Trade Journal*, v. 99, Nov. 17, 1955, p. 561-572.

Facilities, brief outline of its five-year history. Photographs. 3 ref. (E15, A5)

**34-E. Development of the Lost-Wax Process of Precision Casting, 1949-53.** J. S. Turnbull. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 17, 1955, p. 319-325 + 12 plates; disc., p. 325-330.

Limitations of original lost-wax process and improved methods by which the process has extended its application in industry. Economics considered and the scale of manufacture reviewed with a view to mechanization. Diagrams, photographs. (E15)

**35-E. Low-Pressure Casting of Steel in Graphite Moulds.** H. H. Hursen. *Machinery (London)*, v. 87, Nov. 18, 1955, p. 1187-1192.

Mold construction and casting methods. Diagram, photographs. (E12, CI)

**36-E. The A.P.V.-Paramount Shell Moulding Foundry.** *Machinery (London)*, v. 87, Nov. 25, 1955, p. 1224-1232.

Layout of mold-making unit, core blowing unit, vacuum-type shell-closing machine, pattern plates and method of pouring. Machining economies. Photographs, diagram. (E16, G17, SS, Al, Cu)

**37-E. Pressure Die Casting of Aluminium Alloys.** *Machinery (London)*, v. 87, Nov. 25, 1955, p. 1251-1257.

Practice at the works of Wolverhampton Die-Casting Co., Ltd. Deals with dies for office machine part and roller bearing cage, signalling lamp castings, refrigerator control body castings, drill gun castings. Photographs. (E13, Al)

**38-E. American Turbine Blade Production Has Developed Its Own Methods. II.** *Metalworking Production*, v. 99, Nov. 18, 1955, p. 1937-1942.

Fabrication by forging and investment casting. Describes new material developments in plastics and cermets. Photographs. (E15, F22)

**39 E. Coreless Mains Frequency Melting Is Revived.** F. S. Leigh. *Metalworking Production*, v. 99, Nov. 25, 1955, p. 2004-2007.

Design and operating characteristics of induction furnace for cast iron melting. Photographs, diagrams, graphs. (E10, CI)

**40-E. Die Casting Magnesium at McCulloch Motors.** Sherwood H. Egbert. *Modern Metals*, v. 11, Nov. 1955, p. 44 + 7 pages.

Machines and operating procedures for making parts for chain saws and other equipment. Photographs, diagram. (E13, Mg)

**41-E. Influence of Metallurgical Properties of Cast Steel on Tendency to Hot Tearing.** H. Heyer and E. Piwowarsky. *Henry Brutcher Translation No.* 3539, 16 p. (Abridged from *Giesserei*, v. 42, no. 11, 1955, p. 273-279.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 289-E, 1955. (E25, CI)

**42-E. (French.) Solidification of Light Alloys. Study of Piping.** André Tatur. *Fonderie*, 1955, no. 116, Sept., p. 4681-4692.

Morphological characteristics of aluminum alloys with copper, silicon and magnesium; influence of foundry factors on the piping shape using cone-shaped specimens. Photographs, diagrams. 7 ref. (E25, Al)

**43-E. (French.) Cupola Coke.** Maurice Decrop. *Fonderie*, 1955, no. 116, Sept., p. 4693-4698.

Quality criteria for foundry cokes, sampling, and mechanical tests. Table. 21 ref. (E10, B18)

# F

## Primary Mechanical Working

**1-F. Slitting Highly-Finished Stainless Steel.** *Engineering,* v. 180, Oct. 14, 1955, p. 542-544.

Follows process of decoiling, slitting, inspection and coiling of slit strip. Diagram, photographs. (F29, G15, SS)

**2-F. Combustion Systems in Steel Plants.** Fred S. Bloom. *Metal Progress,* v. 68, Nov. 1955, p. 111-115, 200.

Details of high efficiency, high heat transfer, multiple fuel heating systems used in metallurgy. Diagrams, photographs. (F21)

**3-F. Light Alloy Forgings for the Aircraft Industry.** R. H. Daniels. *Metal Treatment and Drop Forging,* v. 22, Oct. 1955, p. 421-424.

Development of dies, forging design and manufacture, and inspection and testing during past 10 yr. Photographs, diagrams. (F22, EG-a)

**4-F. (German.) Principles of Roll Speed Calculation.** Z. Wusatowski. *Metallurgie,* v. 5, no. 9, Sept. 1955, p. 282-289.

Considers speed of a pass and other factors associated with it in continuous mills for hot and cold rolling. Diagrams, tables. 14 ref. (F23)

**5-F. Mechanized Copper Tube Production.** *Metal Industry,* v. 87, Nov. 18, 1955, p. 421-423.

Equipment and operating procedures of drawing plant. Photographs. (F26, Cu)

**6-F. Production of Hot-Rolled Transformer Sheet With Low Core Losses, I-II.** M. Markuszewicz, J. Groyecki and A. Zawada. *Henry Brutcher Translation Nos.* 3573-3574, 36 p. (Abridged from *Prace IMH,* v. 6, no. 3, 1954, p. 105-119.)

Production process for low core loss sheet which gives a consistently high-quality product without cold rolling, or annealing in a hydrogen atmosphere. Experiments to further improve quality of sheet. Graphs, micrographs, tables. 40 ref. (F23, P16, ST)

**7-F. (Russian.) Mode of Operation of Vertical Rolls of Universal Rolling Mill Machinery.** L. F. Molotkov, G. E. Tsukanov and E. M. Bortunov. *Stal',* v. 15, no. 10, Oct. 1955, p. 914-915.

Speed ratios of horizontal and vertical rolls; relation of number of passes, roll edge pressures, reduction ratios, and other parameters. Tables. (F23)

**8-F. (Russian.) Intensification of Reduction Rate for an 1150-MM. Blooming Mill.** A. P. Chekmarev, V. L. Pavlov, V. M. Klimenko, G. E. Tsukanov, E. M. Bortunov and P. A. Vashchilo. *Stal',* v. 15, no. 10, Oct. 1955, p. 916-921.

Studies to speed up rate of rolling steel blooms without impairing quality. Microstructure and mechanical properties of blooms. Tables, micrographs, photograph, diagram. 8 ref. (F23, M27, Q general, ST)

**9-F. Stresses and Strains in Cold-Extruding 2S-O Aluminum.** E. G. Thomsen and J. Frisch. *ASME, Transactions,* v. 77, Nov. 1955, p. 1343-1351 disc., p. 1351-1353.

Flow patterns as represented by instantaneous velocity vectors in an inverted extrusion process of a solid cylindrical bar appear to be identical for both lead and 2S-O aluminum. Axial stress distribution in the billet had the same shape as that determined with lead. Diagrams, graphs. 8 ref. (F24, Q25, Al)

**10-F. Application of Rotary Hearth Furnace for Heating Plate Mill Slabs.** F. C. Schoen. *Iron and Steel Engineer,* v. 32, Nov. 1955, p. 116-123; disc., 123-124.

Installation at Alan Wood Steel Co. with heating and operation data. Diagrams, tables, photographs. (F21, ST)

**11-F. Forge Furnace Research.** *Metal Treatment and Drop Forging,* v. 22, Nov. 1955, p. 459-464.

Report of research program. Photographs. (F22, F21)

**12-F. Lubrication and Cold Extrusion of Steel.** Ernest C. Morse. *Modern Industrial Press,* v. 17, Nov. 1955, p. 36-39.

Summary of selection and application of lubricants in cold extrusion operations. Photographs. (F24, F1)

**13-F. Multiple-Die Forging.** R. G. Moore. *Product Engineering,* v. 26, Dec. 1955, p. 154-157.

New technique extends size range of forgings. Design data given on tolerances and physical properties. Photograph, graph, diagrams, table. (F22, Q general, Al)

**14-F. Extruders Feel Metal Pinch.** *Steel,* v. 137, Nov. 28, 1955, p. 69.

Increased use of aluminum extrusions results in possible dearth in supply of metal. Photograph. (F24, Al)

**15-F. Why the Forging Failed.** *Steel,* v. 137, Nov. 21, 1955, p. 96-98.

Hydrogen embrittlement was found to be the cause of failure of a forged low-pressure turbine spindle shaft. Photographs, micrograph, diagram. (F22, Q23, S21)

**16-F. Keeping Ahead of Extrusion.** *Steel,* v. 137, Nov. 28, 1955, p. 102-103.

Aluminum extrusion presses and procedures; capacity and capabilities. Photographs, table. (F24, Al)

**17-F. Cold Rolling of Phosphated Steel Strip.** W. Lueg and K. H. Treptow. *Henry Brutcher Translation No.* 3583, 23 p. (From *Stahl und Eisen,* v. 75, no. 17, 1955, p. 1085-1092.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 229-F, 1955. (F23, F1, ST)

**18-F. (German.) The Tube Reducing Process as Viewed From the Point of View of Deformation.** Friedrich-Wilhelm Neumann and Dieter Hancke. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1452-1460.

Roll pass design discussed for reducing mills with a free choice of the number of revolutions. Methods of calculation and equations for checking the calculated data. Graphs, diagrams, table, photographs. (F26)

**19-F. (Russian.) Influence of Certain Metallurgical Factors on Specific Losses of Hot-Rolled Transformer Steel.** N. F. Dubrov. *Fizika metallov i metallovedenie,* v. 1, no. 1, 1955, p. 143-148.

Effect of sulfur content on nature of sulfur inclusions and structure of steel; role of aluminum and manganese and maximum contents allowable in relation to annealing temperatures; relation between oxygen content and the kinetics of grain growth; annealing of steel. Graphs, micrographs, tables. 7 ref. (F23, J23, N3, ST)

# G

## Secondary Mechanical Working

**1-G. Apply Correct Clearance and Speed When Drawing Stainless Steels.** Stanley R. Cope. *Metalworking Production,* v. 99, Oct. 28, 1955, p. 1830-1833.

Includes diagrams, tables. (G4, SS)

**2-G. How Modern Materials Influence Sheet-Metalworking.** *Metalworking Production,* v. 99, Oct. 28, 1955, p. 1834-1838.

Summary of papers given at the recent special conference on Modern Materials of the Sheet and Strip Metal Users' Technical Association. Photographs, tables, graphs. (G general)

**3-G. Micromachining With Virtual Electrodes.** A. Uhlir, Jr. *Review of Scientific Instruments,* v. 26, Oct. 1955, p. 965-968.

Minute holes were drilled in germanium, molybdenum, iron, copper, silver and tungsten carbide by electrolytic etching. The flow of current is localized by a nonconducting partition in the electrolyte. Graph, diagrams. (G17, Ge, Mo, Fe, Cu, Ag, W)

**4-G. How to Form Stainless Steel.** *Steel,* v. 137, Nov. 14, 1955, p. 112-115.

Guide to help find right material and best method. Photographs, diagrams, table. (G general, SS)

**5-G. Press Operations on Stainless Steel.** Richard E. Paret. *Tooling and Production,* v. 21, Nov. 1955, p. 75-78.

Cutting, blanking and punching, perforating, bending and roll forming, deep drawing, heat treating, including annealing. Photographs, table. (G1, J23, SS)

**6-G. Press and Spinning Roll Operations Team up for Greater Efficiency.** John H. Bauer. *Tooling and Production,* v. 21, Nov. 1955, p. 83-86.

Application of these techniques to fabrication of automatic washing machine baskets. Photographs, diagrams. (G1, G13, G11, ST)

**7-G. (German.) Flames.** K. W. Sippell. *Metalloberfläche,* Ausgabe A, v. 9, no. 10, Oct. 1955, p. 147-162.

Application of flame in preparing metal surface for painting; advantages over chemical and other methods; estimation of comparative costs. Photographs, table, graphs, diagram. 53 ref. (G22, L10)

**8-G. (German.) Relation Between Flame Method Application and Endurance of Construction Parts.** Siegfried Berg and K. W. Sippell. *Metalloberfläche,* Ausgabe A, v. 9, no. 10, Oct. 1955, p. 179-185.

Application of flame on exchangeable construction parts, effects of flame cleaning on the vibration strength of the construction. Diagrams, tables, photographs, graphs. (G22, L10)

**9-G. (Russian.) Effect of Cooling Time of a Part on the Accuracy of Measurements.** V. E. Smirnov. *Vestnik mashinostroenia,* v. 35, no. 10, Oct. 1955, p. 56-58.

Heating of a cylindrical semi-finished product during cutting affects the accuracy of final dimensions of part being machined. Takes into account thermal deformations of the product during machining for better calculation. Graphs. (G17)

**10-G. Slow Speed Sawing of Metals.** John Roush. *Finish,* v. 12, Dec. 1955, p. 49-50, 90.

Advantages of slow-speed sawing with toothless and toothed bandsaw blades include lower costs, greater safety, longer blade life. Photographs. (G17)

**11-G. Flame - Gouging Performs Many Jobs in Metalworking.** *Linde Tips,* v. 35, Jan. 1956, p. 5-9.

Equipment, operation and applications of oxy-acetylene flame cutting and gouging. Photographs, diagrams. (G22)

**12-G. Milling Cutters With High Relief Angles.** J. Taylor. *Machinery (London),* v. 87, Nov. 4, 1955, p. 1063-1070.

Data for experiments with high-rake cutters, concluding that higher cutting speed is possible for the duration of present tool life, or tool life is prolonged at present cutting speed. Tables, graphs, diagrams, photographs. 5 ref. (G17, CN)

**13-G. Special Machine for Milling Notches in Gas Turbine Blade Roots.** *Machinery (London),* v. 87, Nov. 4, 1955, p. 1073-1074.

Design and operating efficiency. Photographs. (G17)

**14-G. How to Fabricate Welded Steel Tubing.** W. E. McFee. *Modern Machine Shop,* v. 28, Dec. 1955, p. 126-131.

Covers swaging, tube-end forming, punching and notching, and drilling. Diagrams, photographs. (To be continued.) (G general, CN)

**15-G. Research in Metal Turning.** J. C. Hebert and Leif Fersing. *Western Machinery and Steel World,* v. 46, Nov. 1955, p. 70-74.

Methods and equipment developed for setting standards for cutting speeds. Diagrams, graphs, photographs. (G17)

**16-G. Heavy Surface Grinding. III.** John E. Hyler. *Western Machinery and Steel World,* v. 46, Nov. 1955, p. 78-81.

Describes a grinder similar to a way grinder but having a vertical spindle. The amount of material that can be removed at every pass is limited. Photographs. (G18)

**17-G. Report on "Dynatomics".** A. McBride. *Western Machinery and Steel World,* v. 46, Nov. 1955, p. 88-91.

A new coolant that may be used on all machining, boring and grinding operations. The coolant contains ingredients that reduce and limit the amount of heat generated by the plastic flow of material during cutting operations. Photographs, diagrams, micrographs, tables. (G21, G17, G18)

**18-G. Liquid Honing of Metals.** H. H. Finkelnburg. *Henry Brutcher Translation No.* 3596, 10 p. (From *Metall,* v. 7, nos. 9-10, 1953, p. 330-334.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 235-G, 1953. (G19)

**19-G. (Russian.) Study of Distribution of Properties in Surface Layer During Machining of Steel.** I. L. Mirkin and T. A. Sirenko. *Metallovedenie i obrabotka metallov,* 1955, no. 2, Aug., p. 50-56.

Relation between microhardness and original tensile stress in zone of uniform plastic deformation, and between amount of metal removed and surface properties. Tables, diagram, graphs, micrograph. 9 ref. (G17, Q29, ST)

**20-G. (Russian.) Role of Joule-Lenz Heat in Electrical Erosion of Metal.** A. S. Zingerman. *Zhurnal tekhnicheskoi fiziki,* v. 25, no. 11, Oct. 1955, p. 1931-1943.

Erosion is caused by the action of streams of metal vapors caused by the electrical discharge; volume of metal melted by Joule-Lenz heat; influence of contact area; relation of pit diameter to amplitude value of current strength. Photographs, graphs, table. 15 ref. (G17, ST, Al, Cu)

**21-G. Heliarc Cutting of Non-Ferrous Metals.** *Canadian Metals,* v. 18, Nov. 1955, p. 56-57, 60.

New method of using a gas-shielded arc for cutting increases speed, permits saw-like quality cuts, reduces edge preparation costs in nonferrous metals fabrication. Diagram, photographs. (G22)

**22-G. Foundry Practice. X. Fettling Operations.** William H. Salmon and Eric N. Simons. *Edgar Allen News,* v. 34, Nov. 1955, p. 255-256.

Rumbling, shot blasting and hydroblast; surface treatment; and casting salvage by thermit and gas welding. Diagrams. (To be continued.) (G23, E general, K2, K4)

**23-G. Switch to Cold Forming Cuts Production Costs.** W. G. Patton. *Iron Age,* v. 176, Nov. 17, 1955, p. 111-114.

Production operations and advantages of cold heading, cold coining and impact extrusion for forming small parts. Photographs, table. (G3, G5, G10, CN)

**24-G. Chemical Milling Leads to Stronger Structures.** R. W. Spencer and T. F. Freeman. *Iron Age,* v. 176, Nov. 17, 1955, p. 118-119.

Method for chemically "milling" skin sections permits close control and finer tolerances. Cost is 25% that of machining. Part tolerance can be held as close as ±0.005 in. Photographs. (G17)

**25-G. High-Speed Machine Grinds Sintered Parts to Extreme Accuracy.** *Iron Age,* v. 176, Nov. 17, 1955, p. 124-126.

Parts are ground to a 16 μ in. finish in 3 sec. with a three-station, electrohydraulic grinder. Diagram, photographs. (G18)

**26-G. Designing Deep-Drawn Stainless-Steel Parts.** Richard E. Paret. *Machine Design,* v. 27, Dec. 1955, p. 185-189.

Determination of drawing limits, finish effects, proper radii, wall taper. Production considerations. Photographs, diagram. (G4, SS)

**27-G. Machinability of Sintered Bronze.** W. A. Irvine. *Metal Industry,* v. 87, Nov. 25, 1955, p. 446-448.

Machining difficulties encountered at Maytag Co., Newton, Iowa, and methods used to overcome them. Tables, micrographs, photographs. (G17, Cu)

**28-G. Copper Tube Production.** *Metallurgia,* v. 52, no. 312, Oct. 1955, p. 159-163.

Description of a new plant, equipment and procedure for drawing copper tubes. Photographs. (G4, Cu)

**29-G. Aluminum Impact Extrusions.** Bernard F. Wade. *Modern Metals,* v. 11, Nov. 1955, p. 35-36, 38, 40.

Details of high-speed cold working process which produces simple or complex parts in broad range of sizes. Advantages include low cost, tough wrought structure, no draft, accuracy and smooth finish. Photographs, tables. (G5, Al)

**30-G. Determining Surface Area of Sheet Metal Stampings.** L. A. Critchfield. *Products Finishing,* v. 20, Dec. 1955, p. 34-40.

Formulas and nomograms for determining surface areas of stampings which, because of shape and contour, are difficult to measure or calculate from dimensions. Charts. (G3, CN, Al, Cu)

**31-G. Grinding Titanium With Abrasive Belts.** Hugh N. Dyer. *Steel,* v. 137, Dec. 12, 1955, p. 99.

Abrasives, cutting oils, grinding speeds. Table. (G18, Ti)

**32-G. How to Form Zirconium.** *Steel,* v. 137, Dec. 12, 1955, p. 113-114.

Equipment and methods for machining, deep drawing, brazing, welding, forging, rolling, extruding. Photographs. (G general, F general, K general, Zr)

**33-G. How to Apply Carbide Tooling to Automatics.** E. J. Weller. *Tool Engineer,* v. 35, Dec. 1955, p. 103-109.

Application of carbides to multiple bar automatic machines requires attention to details involving the machine, tool design, tool control, materials processed and equipment maintenance. Diagrams, tables, photographs, graphs. (G17)

**34-G. Joining and Finishing of Zirconium. V. Machining.** E. D. Baugh. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 326-331.

Tools and procedures for milling, turning, drilling and punching. Diagrams. (G17, Zr)

**35-G. Joining and Finishing of Zirconium. VI. Grinding.** L. P. Tarasov. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 331-334.

Equipment and methods. (G18, Zr)

## H

## Powder Metallurgy

**1-H. Vibratory Compacting of Metal and Ceramic Powders.** William C. Bell, Richard D. Dillender, Harold R. Lominac and Edward G. Manning. *American Ceramic Society, Journal,* v. 38, Nov. 1955, p. 396-404.

Investigation concerned with forming alumina, chromium-alumina and nickel-titanium carbide powders by low-frequency vibration. Table, graphs, diagram, photograph. (H14, Ti, Ni, Cr, Al)

**2-H. (German.) Preparation of Magnetic Materials by Powder Metallurgy.** Hermann Fahlenbrach and Hans Ringmann. *Elektrotechnische Zeitschrift,* v. 7, Ausgabe B, no. 10, Oct. 1955, p. 373-376.

Production methods, properties, applications of sintered metal powder permanent magnets. Table, graphs, photographs. (H general, SG-n)

**3-H. (German.) Boron-Containing Sinter-Alloy on Base of Iron.** F. Benesovsky, W. Hotop and F. Frehn. *Planseeberichte für Pulvermetallurgie,* v. 3, no. 2, Aug. 1955, p. 57-70.

Experiments with addition of boron to different alloys sintered under vacuum, based on experience obtained with boron addition to alloys in production of permanent magnet materials, resulting in increasing density. Tables, micrographs. 16 ref. (H12, H15, B. AY, SG-n)

**4-H. Cermets.** J. R. Baxter. *Australasian Engineer,* 1955, Sept., p. 45-50.

Reviews cermet development. Bond formation between metal and ceramic phases; effects of the distribution and form of the two phases on the properties of cermets. Graphs, micrographs, tables. 24 ref. (H general)

**5-H. Uniform Density and Structure Possible With Simultaneous High**

**Pressure and Temperature.** R. Humphrey, M. Vilella and L. W. Tomarkin. *Journal of Metals,* v. 7, Nov. 1955, p. 1159-1161.

Summarizes interesting aspects of forming compounds, with many new properties, by the Vitron process. Photographs. (H14)

**6-H. Fiber Metals: A New Metal Form.** A. G. Metcalfe and C. H. Sump. *Materials & Methods,* v. 42, Nov. 1955, p. 96-98.

Introduction to the production, strength and applications of fiber metallurgy. Tables, photographs, micrograph, flowsheet. (H general, Fe)

**7-H. Materials Engineering and File Facts. Standards, Specifications and References for Metal Powders and Metal Powder Products.** *Materials & Methods,* v. 42, Nov. 1955, p. 137, 139, 141.

Cross references for data published by ASTM, MPA, SAE, and federal agencies, including military, with list of addresses. (H general, S22)

**8-H.** (Hungarian.) **Recent Problems of Hungarian Aluminum-Powder Production.** Miklos Hauska. *Kohaszati lapok,* v. 10, no. 10, Oct. 1955, p. 466-473.

Review of powder production abroad; history of production in Hungary and its obstacles; prerequisites for increasing production quality. (H10, Al)

**9-H.** (Russian.) **Compressibility of Boride, Carbide, and Nitride Powders of High-Melting Metals.** G. V. Samsonov and V. S. Neshpor. *Doklady akademii nauk SSR,* v. 104, no. 3, Sept. 21, 1955, p. 405-408.

The particles are almost free of oxide films which influence the electroconductivity of the powder and lower coefficient of friction between particles during pressing or compressing action. Measurement is made of electroconductivity and relative volume. Brittleness factors, microhardness and character of crystal lattice. Graph, table. 7 ref. (H11, Ti, Zr, W)

**10-H. A Method of Preparing Iron Powder for Permanent Magnets.** E. H. Carman. *Metallurgia,* v. 52, no. 312, Oct. 1955, p. 165-168.

Apparatus for hydrogen reduction of small quantities of iron oxide at temperatures between 250 and 350° C. Diagram, graphs, micrographs, table. 3 ref. (H10, Fe)

**11-H. Powder Metallurgy.** T. Raine. *Metropolitan-Vickers, Research Series No.* 3, Apr. 1955, 19 p.

Discusses refractory metals, hard metals, sintered iron and steel products, current developments. Diagrams, graphs, micrographs, tables. 37 ref. (H general)

## J
## Heat Treatment

**1-J. Work Coils for Induction Heating.** D. Warburton-Brown. *Machinery (London),* v. 87, Oct. 28, 1955, p. 1019-1026.

Theory, transformer losses and carrying capacity, cooling, prevention of flash-over, types of coils. Diagrams, graphs, photographs. (To be continued.) (J2)

**2-J. Inco Nickel Alloy Helical Springs. II.** *Mainspring,* v. 16, Oct. 1955, p. 3-10.

Covers thermal treatment used in the fabrication of spring materials and design recommendations. Tables, graphs, photographs. 3 ref. (J general, T7, Ni)

**3-J. Batch-Type Strip Annealing Furnaces.** C. F. Olmstead. *Metal Progress,* v. 68, Nov. 1955, p. 91-94.

Advantages of multiple and single-stack cover furnaces for process annealing of strip include lower fuel or power costs, short annealing cycles and more uniform product. Photographs. (J23)

**4-J. Mechanized Continuous Furnaces.** George C. McCormick. *Metal Progress,* v. 68, Nov. 1955, p. 95-100.

Present machines are classed according to method of handling work and some major considerations are presented which affect a decision to mechanize a heat treating department. Diagrams, photographs. (J general)

**5-J. Mechanized Batch-Type Furnaces.** Martin Neumeyer. *Metal Progress,* v. 68, Nov. 1955, p. 101-104.

Automation of batch-type furnaces offers better metallurgical control, adaptability and portability, lower cost. Graph, diagrams, photographs. (J general)

**6-J. Molten Baths and Mechanisms.** L. B. Rosseau. *Metal Progress,* v. 68, Nov. 1955, p. 106-110.

Requirements impose certain restrictions on the design of handling mechanisms; many types of equipment have been developed for all sorts of heat treating operations. Photographs, diagram, table, graph. (J2)

**7-J. Design of Special Atmosphere Furnaces and Their Application to Heat Treatment of Metals.** I. Jenkins. *Metal Treatment and Drop Forging,* v. 22, Oct. 1955, p. 415-420.

Description of batch-type furnaces, including the bell and pit types: continuous furnaces of the conveyor, pan-conveyor, and roller, shaker and rotary-hearth types. Photographs. (J general, J2)

**8-J. How to Heat Treat Gray Iron.** C. R. Austin. *Modern Castings and American Foundryman,* v. 28, Nov. 1955, p. 30-33.

Four ways to help iron castings meet industrial demands. Diagrams, graphs, photographs, tables. (J general, CI)

**9-J. Titanium and Vacuum Heat-Treating Furnaces.** Roger R. Giler. *Westinghouse Engineer,* v. 15, Nov. 1955, p. 194-197.

Used with hope that contamination will be reduced or eliminated. Diagrams. (J2, J23, C25, Ti)

**10-J.** (Russian.) **Heat Treatment of High-Strength Spheroidal Cast Iron.** T. G. Demidova and M. N. Kuniavskii. *Vestnik mashinostroeniia,* v. 35, no. 10, Oct. 1955, p. 30-34.

Effect of annealing temperature and time on graphitization of eutectic and secondary cementite. Process of carbon solution in gamma-phase and transformations of supercooled austenite. Strength, wear resistance, hardness of the cast iron. Micrographs, graphs. 7 ref. (J general, Q general, CI)

**11-J. Mechanized Heat Treating—The Growing Trend.** O. E. Cullen. *Iron Age,* v. 176, Dec. 1, 1955, p. 99-102.

Advantages and examples of automatic layouts; handling devices and controls. Diagrams, photograph. (J general)

**12-J. Short Cycle Heat Treatment Improves Low Alloy Pipe Production.** James Kniveton. *Journal of Metals,* v. 7, Nov. 1955, p. 1172-1177.

Equipment, operation lines and mill features which turn out superior high-strength oil-well casing from plain carbon and low alloy steels. Photographs, diagram, table. (J general, Q23, CN, AY)

**13-J. Flame Hardened Ductile Irons.** C. E. Ernst, R. V. Adair, and G. L. Cox. *Materials & Methods,* v. 42, Nov. 1955, p. 106-109.

Procedures for improving wear resistance and surface hardness up to Rockwell C64. Graphs, diagram, photographs. 2 ref. (J2, CI)

**14-J. Suitable Heating and Holding Times in the Commercial Heat Treating of Steel.** W. Hülsbruch. *Henry Brutcher Translation No.* 3503, 26 p. (From *Stahl und Eisen,* v. 71, no. 23, 1951, p. 1219-1225.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 18-J, 1952. (J23, Q23, AY)

**15-J.** (Russian.) **Local Tempering by High-Frequency Currents to Increase Structural Strength of Parts.** O. L. Bendryshev and Ia. B. Fridman. *Metallovedenie i obrabotka metallov,* 1955, no. 2, Aug., p. 33-42.

Relation of shape of area being tempered to shape of inductor and part. Various cooling arrangements; plasticity and toughness of bolts and other parts. Method is effective for improving low - tempered quenched steels. Diagrams, graphs, photographs. 14 ref. (J29, J2, ST)

**16-J.** (Russian.) **Isothermal Hardening of High-Strength Spheroidal Cast Iron.** V. I. Prosvirin and N. A. Patrina. *Metallovedenie i obrabotka metallov,* 1955, no. 2, Aug., p. 42-50.

Isothermal transformation of austenite; hardness, wear resistance, fatigue strength, other mechanical properties of high strength cast iron in relation to temperature of quenching medium and time. Variations of heat treatment, including tempering, soaking and normalizing, for ferritic and pearlitic cast irons. Tables, graphs. (J26, N8, CI)

**17-J. Rapid Radiant Heating of Die Blocks.** *Industrial Heating,* v. 22, Nov. 1955, p. 2264, 2266, 2268, 2270.

Furnace employs patterned radiant heat under completely automatic program control. Rapid heating, while maintaining uniform properties, is possible. Graphs, photographs. (J2)

**18-J. Preliminary Examination of the Quenching of Titanium Alloys.** Leonard D. Jaffe. *Journal of Metals,* v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 203, Nov. 1955, p. 1241-1244.

Thermal diffusivity, under quenching conditions, was found to be approximately 0.006 sq. in. per sec. Quenching severity of the Jominy-Boegehold end quench water jet against titanium alloys appeared effectively infinite. Tables, graphs. 25 ref. (J26, Ti)

**19-J. Hardenability of Titanium Alloys Calculated From Composition: A Preliminary Examination.** Leonard D. Jaffe. *Journal of Metals,* v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 203, Nov. 1955, p. 1245-1249.

A single graph gives the contributions of each alloying element which can be added to a base hardenability for unalloyed titanium. Results agree satisfactorily with measured hardenabilities. Table, graphs. 24 ref. (J26, Ti)

**20-J. The Release of Energy During Annealing of Deformed Metals.** L. M. Clarebrough, M. E. Hargreaves and G. W. West. *Royal Society, Proceedings,* v. 232, ser. A, Oct. 25, 1955, p. 252-270 + 1 plate.

Review of mechanisms involved in changes in dislocations and vacancies associated with annealing of deformed nickel and copper and arsenic-copper alloys. Graphs, table. 25 ref. (J23, M26, Ni, Cu)

**21-J. Heat Treating Ductile Iron. I.** Robert E. Savage. *Steel,* v. 137, Nov. 21, 1955, p. 108-109.

Stress-relief and softening heat treatments. Graph, table. (J1, J29, CI)

**22-J. Heat Treating Ductile Iron. II.** Robert E. Savage. *Steel,* v. 137, Nov. 28, 1955, p. 109, 112, 114-115.

Hardening treatments, including normalizing, quenching and martempering, all followed by tempering. Induction and flame surface hardening. Graphs, micrographs, table. (J general, CI)

**23-J. Heat Treating Gray Iron. III.** *Steel,* v. 137, Nov. 7, 1955, p. 134-136.

A continuation of surface hardening processes to include the results achieved from through hardening and hot quenching techniques. Photograph, graphs. (J26, CI)

**24-J. The Metallographic View.** H. E. Boyer. *Steel Processing,* v. 41, Nov. 1955, p. 716-717.

Effect of composition on hardenability of carbon and alloy steels. Graphs. (J26, M general, CN, AY)

**25-J. Flame Hardening — Modern Methods and Equipment.** John E. Hyler. *Steel Processing,* v. 41, Nov. 1955, p. 725-730, 733.

Torch capacities for large surfaces; special types of set-ups; burner design; fuels. Hardening procedures for gears. Photographs. (J2)

**26-J. Mechanical Properties and Wear Resistance of Gas Cyanided Auto Parts.** A. M. Tarasov and B. A. Stetsenko. *Henry Brutcher Translation No.* 3588, 9 p. (Abridged from *Avtomobil'naya i traktornaya promyshlennost,* 1955, no. 3, p. 21-24.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 106-J, 1955. (J28, M27, Q23, Q9)

**27-J. Interstage Annealing of 13 Percent Chromium Stainless Steel.** Z. Wojcik. *Henry Brutcher Translation No.* 3612, 8 p. (From *Biuletyn informacyjny (Hutnik),* v. 6, no. 2, 1955, p. 5-7.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 134-J, 1955. (J23, N8, SS)

**28-J. (French.) Stabilizing Heat Treatment of Aluminum-5% Magnesium Alloys Against Effects of Heating at Low Temperatures.** André Guilhaudis. *Revue de l'aluminium,* v. 32, no. 224, Sept. 1955, p. 795-801.

Influence of heat treatment on the intercrystalline corrosion properties of A-G5 alloy, from 75 to 125° C. Proposed method and its optimum conditions. Table. graphs, micrographs. 9 ref. (J1, R2, Al)

**29-J. (German.) Present State of Reheating and Annealing Furnaces in Sheet-Rolling Mills.** Otto Schneider. *Stahl und Eisen,* v. 75, no. 22, Nov. 3, 1955, p. 1460-1472.

Furnace control for sheet bar and pack reheating furnaces for hot rolling; annealing of wide strip coils in radiant-tube and directly fired bell-type furnaces, and in continuous furnaces. Diagrams, graphs, photographs, tables. 6 ref. (J23, F21, CN)

# K

## Joining

**1-K. Welding Copper and Its Alloys.** R. A. Cresswell. *Metal Industry,* v. 87, Oct. 7, 1955, p. 299-302, 308.

Effects of physical and mechanical properties on joints. Micrograph, tables, graph, photographs. 9 ref. (To be continued.) (K general, P general, Q general, Cu)

**2-K. Welding Aluminium Alloys.** J. F. Lancaster. *Metal Industry,* v. 87, Oct. 21, 1955, p. 339-342; Oct. 28, 1955, p. 369-370.

Considers physical problems of heat flow, weld pool, oxide films, porosity. Discusses heat treatable and non heat treatable alloys. Radiographs, photograph, graphs, tables. 7 ref. (To be continued.) (K general, Al)

**3-K. Projection Welding Aluminium.** *Metalworking Production,* v. 99, Oct. 28, 1955, p. 1827-1829.

Techniques for resistance projection welding aluminum alloys on a production basis. Photographs. (K3, Al)

**4-K. Arc Welding Power Sources.** John H. Blankenbuehler. *Welding Engineer,* v. 40, Nov. 1955, p. 23-26.

Three welding types compared to determine best. Flow-sheet, tables. (K1)

**5-K. Improvements in Design Performance.** A. J. Rosenberg and B. Townshend. *Welding Engineer,* v. 40, Nov. 1955, p. 35-36, 38.

Attempts to evolve mechanical design standards for automatic submerged-arc welding which take into account the beneficial effects of penetration. Diagrams, graphs. (K1)

**6-K. An Application of Pressure Welding to Fabricate Continuous Welded Rail.** David C. Hastings. *Welding Journal,* v. 34, Nov. 1955, p. 1065-1069.

Railroads use method for smoother riding tracks and decreased maintenance. Photographs. (K2)

**7-K. Lower Part Cost by Projection Welding.** C. H. Burgston. *Welding Journal,* v. 34, Nov. 1955, p. 1070-1080.

Cost savings and increased production result when certain types of farm implement parts, formerly fabricated by arc welding, are redesigned to be fabricated by resistance projection welding. Photographs, diagrams, table. (K3, ST)

**8-K. Seam Welding Dissimilar Thicknesses of Low-Carbon Steel.** M. L. Begeman and E. J. Funk. *Welding Journal,* v. 34, Nov. 1955, p. 529S-534S.

Proper conditions for fabrication of pressure-tight joints in sheets determined through laboratory investigation. Tables, graphs, micrographs. (K3, CN)

**9-K. Lithium Additions to Brazing Alloys.** N. Bredzs and D. Canonico. *Welding Journal,* v. 34, Nov. 1955, p. 535S-543S.

Investigation indicates that lithium is a most suitable metal for developing self-fluxing alloys. Tables, graphs, diagram, micrographs. 8 ref. (K8, Li)

**10-K. Investigation of Weld-Metal Cracking in High-Strength Steel.** R. P. Sopher, A. J. Jacobs and P. J. Rieppel. *Welding Journal,* v. 34, Nov. 1955, p. 544S-552S.

Hot-cracking resistance studies show that increasing carbon, sulfur and phosphorus contents cause adverse effects. Table, photograph, diagrams, graphs, micrographs. 4 ref. (K9, ST)

**11-K. Temper Brittleness of 1Cr-1/2Mo Weld Metal.** W. J. Lester and G. R. Prescott. *Welding Journal,* v. 34, Nov. 1955, p. 553S-557S.

Investigation of weld failures in one of the first catalytic-cracking reactors; properties of the welds with several types of electrodes. Tables, micrographs, diagram. 3 ref. (K9, Q23, AY)

**12-K. Fusion Welding of 24S-T3 Aluminum Alloy.** J. B. Arthur. *Welding Journal,* v. 34, Nov. 1955, p. 558S-569S.

Report of extensive research program and data on determination of procedures required for successful production welding. Tables, micrographs, diagram, graph, photographs. (K general, Al)

**13-K. (English.) The Place of Metal Bonding in Modern Aircraft Structures.** E. Van Beek. *Technique et science aéronautiques,* 1955, no. 4, p. 257-260.

Judicious use of glued or glue reinforced joints considered. Photographs. (K12)

**14-K. (Russian.) Influence of Nitrogen on the Metal During Argon-Arc Welding of a Stainless Steel Seam.** A. V. Petrov. *Svarochnoe proizvodstvo,* 1955, no. 10, Oct., p. 7-10.

Welding of 1Kh18N9T steels, when nitrogen is present in argon, results in a nitrogen saturation of the metal at the seam, with the formation of stable titanium nitrides; eliminates the stabilization properties of titanium as a carbide forming element; attributes to the formation of hot cracks. Tables, graphs, micrographs. 9 ref. (K1, SS)

**15-K. (Russian.) Zone of Fusion of Austenitic and Pearlitic Steels.** L. S. Livshits. *Svarochnoe proizvodstvo,* 1955, no. 10, Oct., p. 14-16.

Investigates heterogeneity of seam structure during welding and influence of electrode composition and post-welding heat treatment. Table, graph, micrographs, photograph. (K1, AY)

**16-K. A New Test Specimen for Side Fillet Welds.** A. M. Mackie. *British Welding Journal,* v. 2, Nov. 1955, p. 501-503.

A test specimen for side fillet welds which provides essential data for stress analysis of joints. The test machine is described, and test results given. Graphs, photographs, table. (K9, Q25)

**17-K. Double-Fillet Test for Research Into Hot Cracking of Weld Metal.** K. Winterton and E. G. P. Hinds. *British Welding Journal,* v. 2, Nov. 1955, p. 513-525.

Outlines double fillet test, including necessary precautions to be taken in performing the test. Photographs, diagrams, graphs, tables. 9 ref. (K9)

**18-K. Fastenings That Hold the Future.** *INCO,* v. 26, no. 6, Oct. 1955, p. 27-31.

Nontechnical discussion of high-temperature, corrosion resistant fastenings. Photographs. (K13)

**19-K. Welding Copper and Its Alloys.** R. A. Cresswell. *Metal Industry,* v. 87, Oct. 14, 1955, p. 323-325.

Satisfactory results are realized since the newer, cleaner and faster inert-gas shielded-arc welding processes allow welding without the use of fluxes. Micrographs, photograph. (K1, Cu)

**20-K. A Preliminary Report on the Brazing of Titanium to Titanium, and Mild and Stainless Steels.** W. J. Lewis, P. S. Rieppel and C. P. Voldrich. *Sheet Metal Industries,* v. 32, no. 343, Nov. 1955, p. 833-848.

Evaluates various commercial brazing alloys, brazing equipment, procedures used; metallographic studies of brazed joints; results obtained in brazing tests. Diagram, photographs, tables. (K8, M general, Ti)

**21-K. Welding and Metal Fabrication on the Handley Page Herald.** P. H. F. Burton and N. K. Gard-

ner. *Welding and Metal Fabrication,* v. 23, Nov. 1955, p. 410-416.

Construction methods, with particular emphasis on numerous spot welds used. Mechanical properties and test results on alloys used. Photographs, diagrams. 2 ref. (K3, Q general, EG-a)

**22-K. Reasons for the Hot Cracking of Welds.** V. V. Podgaetskii. *Henry Brutcher Translation No.* 3536, 7 p. (From *Avtomaticheskaya svarka,* v. 7, no. 6, 1954, p. 73-76.) Henry Brutcher, Altadena, Calif.

Correlates hot cracking in weld metal and contents of carbon, sulfur and manganese of the metal with low and high-silica fluxes; effects of carbon. (K9, ST)

**23-K. Formation of Hot Cracks in Butt Welds With Extension Tabs.** S. L. Mandel'berg and O. S. Zabarilo. *Henry Brutcher Translation No.* 3550, 8 p. (Abridged from *Avtomaticheskaya svarka,* v. 7, no. 6, 1954, p. 29-32.) Henry Brutcher, Altadena, Calif.

Causes of hot cracking in butt welds; use of slits between tabs and main plate and their role in connection with hot cracking of butt welds. Tables, diagrams, photographs. (K9)

**24-K. Manufacture and Properties of Metal-to-Metal Laminates.** J. J. Saunders and H. R. Merriman. *Aero Digest,* v. 71, Nov. 1955, p. 52-54.

Process of bonding several large sheets of aluminum to form various thicknesses. Photograph, graphs. (K12, Al)

**25-K. A Rational Approach to Welding Titanium.** K. L. C. Legg. *Aircraft Engineering,* v. 27, Nov. 1955, p. 374-375.

Argon-arc butt welding of thin commercially pure titanium sheet without filler rod. Tables, graph. 2 ref. (K1, Ti)

**26-K. Brazing Nichrome V With GE-81 Alloy.** H. A. Saller, J. T. Stacy and H. L. Klebanow. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-947, Aug. 1954, 18 p.

Tensile strengths, ductilities, effects of annealing. Diagram, photographs, graphs. (K8, Q23, J23, Ni)

**27-K. Self-Adjusting Welding Arcs: Drift in Power Source Output and Electrode Feed Rate.** J. C. Needham. *British Welding Journal,* v. 2, Nov. 1955, p. 506-513.

Measurement, under typical working conditions, of drift in the output of two commercial types of welding plants and the pre-set electrode feed rate of a commercial unit for self-adjusting arcs. Graphs, diagram. 2 ref. (K1)

**28-K. Inert Gas Welding of Aluminum Alloys. I.** M. J. Waite. *Canadian Metals,* v. 18, Nov. 1955, p. 62, 64, 66, 68.

Principal aluminum welding processes, with particular reference to the application of these processes in welding aluminum alloys. Photographs. (K general, Al)

**29-K. Rapid Welding Techniques Speed Girder Fabrication.** Edward Brocke. *Iron Age,* v. 176, Nov. 17, 1955, p. 116-117.

Semi-automatic submerged arc welding is supplemented by manual methods, using iron powder type electrodes. Speed of welding with wire feed averages 13 to 14 in. per min. Photographs. (K1)

**30-K. Weld Titanium Sheet Leftovers Into Machinable Billets.** C. W. Shipley. *Iron Age,* v. 176, Nov. 24, 1955, p. 90-91.

Pieces of sheet can be stacked and spot welded to produce a small billet suitable for machining. Photographs. (K3, G17, Ti)

**31-K. Polymer to Metal Adhesion. The System Polyvinyl Acetate-Steel.** S. W. Lasoski, Jr., and Gerard Kraus. *Journal of Polymer Science,* v. 18, Nov. 1955, p. 359-376.

In the limit of small film thickness the effective tensile adhesion of polyvinyl acetate to steel is of the order of the tensile strength of the polymer. Scrupulous cleanliness is essential for successful bonds; a trace of fatty acid nearly halved the bond strength. Tables, graphs. 21 ref. (K11, ST)

**32-K. Selecting Electrodes and Welding Rods. II. Stainless Steels.** Helmut Thielsch. *Machine Design,* v. 27, Dec. 1955, p. 195-199.

Properties and characteristics of filler metals. Photographs, tables. 2 ref. (K1, SS)

**33-K. Brazing Aluminium.** R. H. Warring. *Machinery Lloyd (Overseas Ed.),* v. 27, Nov. 19, 1955, p. 73, 75-78.

Includes diagrams, tables. (K8, Al)

**34-K. Welding Aluminium Alloys.** J. F. Lancaster. *Metal Industry,* v. 87, Nov. 4, 1955, p. 389-390.

Characteristics of various alloys in relation to welding. Graphs. 3 ref. (K general, Al)

**35-K. Plastic Bonding for Metals.** R. A. Johnson. *Metal Industry,* v. 87, Nov. 25, 1955, p. 443-445.

Bonding of metals by the use of synthetic resin adhesives. Photographs. (K12)

**36-K. Some Fundamental Aspects of Rubber-Metal Adhesion.** D. M. Alstadt. *Rubber World,* v. 133, Nov. 1955, p. 221-231, 240.

Structure and nature of the rubber, the adhesive polymer and the metal as they relate to adhesion. Diagrams, micrographs. 17 ref. (K11)

**37-K. Submerged Automatic Arc Welding of Rusty Steel.** A. G. Mazel and B. P. Vasil'kov. *Henry Brutcher Translation No.* 3591, 9 p. (From *Avtomaticheskaya svarka,* v. 7, no. 6, p. 44-51.) Henry Brutcher, Altadena, Calif.

Effects of welding current and arc voltage on porosity, particle size of flux, type of weld, moisture in rust, manganese, silicon and carbon on pore formation, and of rust on weld properties. Micrograph, graphs. 6 ref. (K1, ST)

**38-K. Joining and Finishing of Zirconium. I. Arc Welding.** D. C. Martin. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 307-320.

Directions for obtaining welds of good appearance and soundness. Weld properties. Photographs, graphs, micrographs, tables. (K1, Zr)

**39-K. Joining and Finishing of Zirconium. II. Resistance Welding.** A. H. Kasberg. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 320-322.

Review of work that has been done indicates that no serious problems other than contamination are encountered. (K3, Zr)

**40-K. Joining and Finishing of Zirconium. III. Solid-Phase Welding.** S. J. Paprocki. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 322-325.

Bonding and cladding methods, including roll cladding, swaging and drawing, and powder metallurgical techniques. Graph. (K5, L22, H general, Zr)

**41-K. Joining and Finishing of Zirconium. IV. Brazing.** J. R. Keeler. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 325-326.

Exploratory tests of various fluxes, brazing alloys and techniques. (K8, Zr)

**42-K.** (German.) **Applicability of Alternating Current for Deep-Penetration Welding.** Herbert Neumann. *Schweissen und Schneiden,* v. 7, no. 10, Oct. 1955, p. 415-423.

Fundamentals of deep-penetration welding; influence of current on weld and of increased voltage and current on penetration and weld shape. Diagrams, tables, graphs, photographs. (K1)

**43-K.** (German.) **What Is to Be Observed in Gas Welding Cast Iron?** Hans Reininger. *Schweissen und Schneiden,* v. 7, no. 10, Oct. 1955, p. 424-429.

Differences in welding rolled steel and cast iron; correct and homogeneous preheating; welding of gray cast iron. Micrographs, photographs, tables. (K2, CI)

**44-K.** (Swedish.) **Properties and Application of Penetration Electrodes and High Exchange Electrodes.** Erik Magnusson. *Svetsaren,* v. 20, no. 1, 1955, p. 1-13.

Investigation on increasing the rate of welding in order to decrease working time. Theory of various electrodes and their economic advantages. Tables, graphs, photograph. (K1)

**45-K.** (Book—German.) **Joining and Fastening Elements for Instruments.** Hermann Pöschl. 108 p. 1954. Springer-Verlag, Berlin, Germany.

Methods for connecting and joining different parts in instruments used for precision work. (K13)

## L

## Cleaning, Coating and Finishing

**1-L. How to Finish Stainless Steel.** Richard E. Paret. *American Machinist,* v. 99, Nov. 7, 1955, p. 129-144.

Producing various degrees of finish by abrasion and electrochemical methods, also covers etching, pickling, decorative finishing processes. Photographs, tables. (L general, SS)

**2-L. Evaluating Physical Properties of Coatings.** J. I. Richardson. *Chemical Engineering,* v. 62, Nov. 1955, p. 242, 244, 248.

A coating, in addition to supplying chemical resistance, must also meet standards of permeability, thickness, adhesion, flexibility and abrasion. Photographs. (L general, S general)

**3-L. Bitumen in the Prevention and Control of Corrosion. I.** R. P. Bell and K. A. Wheeldon. *Corrosion Prevention and Control,* v. 2, Oct. 1955, p. 30-34.

Definition, origin, properties, classification and method of producing bitumen. Photographs. (To be continued.) (L26, ST, Fe)

**4-L. Bituminous Products.** *Corrosion Prevention and Control,* v. 2, Oct. 1955, p. 35-39, 64.

Review of anticorrosive coatings and compounds. Photographs. (L26, ST, Fe)

**5-L. Chromium Impregnation for Corrosion Resistance and Heat Protection.** *Electrical Manufacturing,* v. 56, Nov. 1955, p. 150-152.

Superior properties and lower costs make surface diffusion of chromium compete, in many applications, with stainless steel, chromium or nickel plating. Micrograph, photographs. (L15, Cr)

**6-L. Some Properties of Tin (II) Sulfate Solutions and Their Role in Electrodeposition of Tin. III. Solutions With Tin (II) Sulfate, Sulfuric Acid, and Addition Agents.** C. A. Discher. *Electrochemical Society, Journal,* v. 102, Nov. 1955, p. 617-622.

Cathode deposit obtained is clearly related to the surface tension, molar refraction, van't Hoff's *i*, and equivalent conductance of the solution. In terms of the cathode process, the data indicate that increased polarization favors better deposits. Graphs, diagrams, table. 7 ref. (L17, Sn)

**7-L. Electrodeposition of Titanium on Base Metals.** M. E. Sibert and M. A. Steinberg. *Electrochemical Society, Journal,* v. 102, Nov. 1955, p. 641-647.

A rapid, inexpensive process whereby thin layers are bonded to steel or other base metals by fused salt electrolysis. Using high currents and voltages with small amounts of titanium, the layer completely protects the coated article with all the corrosion resistance properties of titanium itself, and is firmly bonded by an alloy interface. Tables, photographs, micrographs. 10 ref. (L17, Ti)

**8-L. The Kinetics of Formation of Anodic $Ta_2O_5$—Further Studies.** D. A. Vermilyea. *Electrochemical Society, Journal,* v. 102, Nov. 1955, p. 655-659.

New data show that the activation energy for the process is not a single linear function of the applied electric field, and that the preexponential factor is also a function of the applied field. Graphs, table. 7 ref. (L19, Ta)

**9-L. Surface Contamination of Copper by Phosphate Ion During Electropolishing Use of $P^{32}$.** N. H. Simpson and Norman Hackerman. *Electrochemical Society, Journal,* v. 102, Nov. 1955, p. 660-661.

Since oxidation occurs in boiling water system, an optimum condition for removal of phosphate is shown. (L13, R2, P, Cu)

**10-L. Electrolytic Processes for Surface Conditioning of Metals.** J. W. Cuthbertson. *Institution of Electrical Engineers, Proceedings,* v. 102, pt. A, no. 5, Oct. 1955, p. 501-509.

Surface cleaning, descaling and finishing of metal and improving resistance of aluminum and its alloys to oxidation and abrasion. Diagrams. 29 ref. (L13, L19, Al)

**11-L. Chemical and Anodic Treatments.** V. F. Henley. *Light Metals,* v. 18, Oct. 1955, p. 347-348.

Critical review of British patents dealing with surface treatment of aluminum. (To be continued.) (L general, Al)

**12-L. The Structure of Electrodeposited Metals.** Rolf Weil and Harold J. Read. *Metal Finishing,* v. 53, Nov. 1955, p. 60-65.

Effect of plating variables on the structure by studying the surfaces with an electron microscope. Micrographs, table. (To be continued.) (L17, M27)

**13-L. Continuous Hot Galvanizing of Strips.** Nelson E. Cook. *Metal Finishing,* v. 53, Nov. 1955, p. 67-69; 73.

Advanced techniques for tight coating. Photographs. (L16, ST)

**14-L. Electroplating on Porous Metal.** J. B. Mohler. *Metal Finishing,* v. 53, Nov. 1955, p. 70-73.

Problems of plating, process, and appearance, some corrective steps. Powder metal parts also discussed. Diagrams, tables, micrographs. 6 ref. (L17, H general)

**15-L. Surface Treatment and Finishing of Light Metals. VII. Industrial Anodizing of Aluminum and Its Alloys.** S. Wernick and R. Pinner. *Metal Finishing,* v. 53, Nov. 1955, p. 74-77.

Discusses oxalic, sulfamic and phosphoric acid and Peintal processes, opaque and barrier coatings. Graphs. 14 ref. (L19, Al, EG-a)

**16-L. Science for Electroplaters. VIII. Solutions.** L. Serota. *Metal Finishing,* v. 53, Nov. 1955, p. 78-81.

Basic terms and processes used. Graphs, table. (L17)

**17-L. Vitreous Enamel Coatings on Light Metals.** F. J. Biechler and J. J. Meynis de Paulin. *Metal Industry,* v. 87, Oct. 7, 1955, p. 303-305.

Low melting point, high coefficient of thermal expansion, resistance to action of water, hardness, absence of corrosion on light metal surface and bright gloss retained under wide range of conditions. Tables. (L27, EG-a)

**18-L. Automatic Rinsing Control.** J. B. Mohler. *Metal Industry,* v. 87, Oct. 21, 1955, p. 343-346.

Because of water shortages and costs, controlled flow, fog and spray rinses, multiple rinsing and automatic control have been tried in electroplating lines to reduce soluble chemicals on work. Graphs, diagrams, tables, photograph. 4 ref. (L17, S18)

**19-L. Mold Making by Electroforming.** S. Fialkoff. *Plastics Technology,* v. 1, Oct. 1955, p. 542-544, 559.

Intricate molds are reproducible and have interior finishes that do not require further polishing. Photographs, diagram. (L18)

**20-L. A Strip Coating Line for High Production Painting of Coil Stock.** Roland Harrison. *Products Finishing,* v. 20, Nov. 1955, p. 34-39.

Roller coating unit applies paint to both sides of coil stock simultaneously. Photographs, diagrams. (L26, Al)

**21-L. Tiny Electronic Parts Tumbled to Precision Finishes.** A. W. Kollosch. *Products Finishing,* v. 20, Nov. 1955, p. 82-86.

Estimates tolerances, lists steps of correct tumbler loading, discusses general run and quality control. Photographs. (L10)

**22-L. (German.) Present Position of Flame-Spray Technique and Fluidization Sintering.** E. Gemmer. *Chemie-Ingenieur-Technik,* v. 27, no. 10, Oct. 1955, p. 599-600.

Both methods are used to provide corrosion resistant insulating and abrasion proof coats of plastics on metals or other basic materials. Diagrams, graphs, photograph. (L26)

**23-L. (German.) State of Steel Surface After Application of Various Rust and Scale-Removing Procedures.** F. Nieth. *Metalloberfläche,* Ausgabe A. v. 9, no. 10, Oct. 1955, p. 174-178.

Compares existent methods of rust and scale removing with flame method. Micrographs, graphs, table. 6 ref. (L10)

**24-L. (German.) Formation of Electrodeposits of Alloys. IX. Silver-Thallium Alloys.** Ernst Raub and Fritz Sautter. *Metalloberfläche,* Ausgabe B, v. 9, no. 10, Oct. 1955, p. 145-147.

Potential measurements in silver baths with and without thallium salts. Relation between thallium content of deposits and current density. Hardness and structure of deposits. Graphs. 5 ref. (L17, Ag, Tl)

**25-L. (German.) Influence of Material Shape on Chemical Polishing of Chromium-Nickel Steels.** Arvid v. Krusenstjern and Hans Schlegel. *Metalloberfläche,* Ausgabe B, v. 9, no. 10, Oct. 1955, p. 148-151.

Relation between item shape and gloss determined by means of a gloss-measuring device and microphotography. Photographs, diagrams, table, micrographs. 2 ref. (L12, SS)

**26-L. (Russian.) Protecting Stainless Steels From Corrosion by Anodic Polarization.** N. D. Tomashov and G. P. Chernova. *Doklady akademii nauk SSSR,* v. 104, no. 1, Sept. 1, 1955, p. 104-107.

Anodic polarization curves of chromium-nickel steels in various sulfuric acid concentrations at 25° C. Effectiveness of anodic oxide coating against corrosion. Table, graphs. 10 ref. (L19, SS)

**27-L. (Russian.) Electrochemical Method of Removing Zinc From Zinc-Coated Iron.** N. P. Fedot'ev and G. G. Khad'mash. *Zhurnal prikladnoi khimii,* v. 28, no. 10, Oct. 1955, p. 1104-1112.

In the alkaline corrosion of zinc an accelerating effect of the iron surface on dissolving the zinc from the coated iron was observed, indicating the necessity of working with insoluble anodes. A simple method of removing zinc consists of treating the sections in a sodium hydroxide solution, removing the iron, extracting the zinc by electrolysis with an insoluble anode, and remelting the cathodic deposits. Tables, graphs, photograph. 10 ref. (L13, Zn, Fe)

**28-L. Protection of Low-Strategic Alloys With a Chromium-Boron-Nickel Cermet Coating.** D. G. Moore and J. R. Cuthill. *American Ceramic Society Bulletin,* v. 34, Nov. 1955, p. 375-382.

In using ceramic coating techniques, the novel feature of the process is the fluxing action of the frit admixture which permits welding of the cermet particles to occur during firing without highly purified, oxygen-free atmosphere. Photographs, micrographs, tables. 8 ref. (L27, Cr, B, Ni)

**29-L. Fabrication and Evaluation of Thin Clad Sheets of Molybdenum.** M. H. LaChance and R. I. Jaffee. *American Society for Metals, Transactions,* v. 48, *Preprint No.* 43, 1955, 34 p.

System of cladding molybdenum with a base coat of nickel alloy, either in vacuum or by electroplating, for service up to 2000° F. An edge-cladding system is also described. Graphs, micrographs, tables. 6 ref. (L22, Mo)

**30-L. Continuous Processing of Steel Strip.** J. B. Mohler. *Automation,* v. 2, Dec. 1955, p. 37-43.

Various automation problems and their solutions. Photographs, diagrams. (L17, A5)

**31-L. Phosphatizing Auto Bodies at Chrysler.** Gilbert C. Close. *Finish,* v. 12, Dec. 1955, p. 46-47, 90.

Equipment and operation of production-line processing 800 auto bodies in two 8-hr. shifts. Photographs. (L14)

**32-L. Lacquers, Synthetic Enamel Coatings and Stoving Finishes.** A. A. B. Harvey. *Industrial Finishing (London),* v. 9, Oct. 1955, p. 143-145.

General description of automotive finishing. Photographs. (L26)

**33-L. The Adhesion of Vacuum-Evaporated Metal Films.** F. C. Weil.

*Institute of Metal Finishing, Bulletin,* v. 5, Autumn 1955, p. 169-176.

Technique for vacuum evaporation of metals and alloys, mechanism of formation of evaporated film on metallic or nonmetallic surfaces. Factors making for good and bad adhesion. 3 ref. (L25)

**34-L. Proper Rinsing Practice Curbs Pinpoint Corrosion.** L. J. Brown, Samuel Spring and W. J. Hennessey. *Iron Age,* v. 176, Dec. 1, 1955, p. 110-114.

Pinpoint rusting of cold rolled steel can be influenced by rinse water composition. Rinsing off offending ions with distilled water or steam condensate will prevent this form of corrosion. Maps, photographs, tables. 4 ref. (L12, CN)

**35-L. Phosphating Etch Primers.** Régine Bourbon and Jean-Jacques Meynis de Paulin. *Metal Industry,* v. 87, Sov. 18, 1955, p. 424-427.

Tests of coatings on aluminum alloys, including resistance to water and ultra-violet light. Photographs, tables. (L26, L14, Al)

**36-L. Deposition of Silver From Solutions of Simple Silver Salts.** H. Heiling. *Henry Brtucher Translation No.* 3580, 25 p. (From *Metall,* v. 8, nos. 11-12, 1954, p. 438-448.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 589-L, 1954. (L17, Ag)

**37-L. Quality Indexes for Electroplating Installations.** W. Nohse. *Henry Brutcher Translation No.* 3586, 13 p. (From *Metallwaren-Industrie und Galvanotechnik,* v. 45, no. 11, 1954, p. 527-533.) Henry Brutcher, Altadena, Calif.

Suggests practical data that should go with new equipment and how the customer can evaluate his purchase. Quality indexes as to performance. Diagrams. (L17)

**38-L. Leveling Power of Electroplating Baths.** *Henry Brutcher Translation No.* 3587, 13 p. (From *Metallic bulletin (Holland),* v. 3, no. 10, 1954, p. 233-242; no. 11, p. 261-263.) Henry Brutcher, Altadena, Calif.

Data on leveling power of Dutch and American proprietary nickel and copper plating baths. Micrographs. (L17, Cu, Ni)

**39-L. (Russian.) Physico-Chemical Basis for Diffusion Coating Formation on the Surface of Iron and its Alloys.** N. S. Gorbunov. *Izvsetiia akademii nauk SSSR, otdelenie khimicheskikh nauk,* 1955, no. 5, Sept.-Oct., p. 793-799.

Data on diffusion coatings, from elements of groups I through VII of the periodic system, include atomic diameters in angstroms and solubility of a given element in iron at room and high temperatures. Factors making formation of diffusion coatings possible include closeness of types of crystal lattices of element applied and of iron, and smaller atomic diameter of diffusing element. Tables, graph. 11 ref. (L15, M26, Fe)

**40-L. Potential Measurements of Aluminum-Clad Uranium Systems.** Arch B. Tripler, Jr., John G. Beach and Charles L. Faust. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-997, May 1955, 8 p.

Experimental data support the fact that uranium corrodes faster when coupled to nickel and aluminum than when coupled to AlSi and aluminum. (L22, R1, U)

**41-L. The Painting of Structural Steelwork.** *Corrosion Technology,* v. 2, Nov. 1955, p. 341-342.

Ten-year investigation results involving priming paints, protective paints based on tars and bitumens, metallic coatings, and methods of surface preparation. Photographs. (L26, ST)

**42-L. Factors Affecting the Formation of Anodic Oxide Coatings in Sulfuric Acid Electrolytes.** Ralpn B. Mason. *Electrochemical Society, Journal,* v. 102, Dec. 1955, p. 671-675.

Amount of sulfate on pure aluminum increased as the current density and concentration of acid increased, but decreased as the temperature was raised. Graphs, tables. 5 ref. (L19, Al)

**43-L. Properties and Uses of Heavy Nickel Deposits.** J. W. Oswald. *Electroplating and Metal Finishing,* v. 8, Nov. 1955, p. 379-383.

Plating solutions, adhesion requirements, finishing and resulting properties, corrosion aspects, applications, comparison with other methods of surface finishing. Diagram, graphs, photographs, tables. 5 ref. (L17, R general, Ni)

**44-L. The Use of Heat in the Application of Organic Finishes.** J. N. E. Fairrie. *Electroplating and Metal Finishing,* v. 8, Nov. 1955, p. 389-394.

Hot spray process and equipment. Tables, photographs. 4 ref. (L26)

**45-L. Determination of Correct Baking Procedures for Enamelled Wires.** L. Kolar. *Engineers' Digest,* v. 16, Oct. 1955, p. 477-478. (Translated from *Elektrotechnicky Obzor,* v. 44, no. 4, 1955, p. 181-186.)

Correct degree of baking determined by testing and correlating test results of the dielectric constant, enamel resilience during reeling, thermal shock, and mechanical and electrical properties under torsion. Graphs, table. (L26)

**46-L. Oxide and Silicon Carbide Coatings for High Temperature Resistance.** *Industrial Heating,* v. 22, Nov. 1955, p. 2352 + 4 pages.

Coatings protect the base material against erosion and provide thermal insulation; oxides are sprayed on the base metal in a molten condition. Diagram, photographs, tables. (L14, L26)

**47-L. The B.N.F. Jet-Test on Organic Bright Nickel Deposits.** J. Edwards. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 17-30.

Rate of penetration of organic bright nickel deposits in the B.N.F. jet-test shown to vary with the thickness of deposit. Therefore, to determine thickness by this method it is necessary to use a calibration curve relating apparent and true thickness. Tables, graphs, diagrams. (L17, S14, Ni)

**48-L. Electrodeposition and the Printing Trade.** J. Riley. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 61-76.

Printing processes, electrotyping, electro-deposition methods and equipment. Tables. 2 ref. (L17)

**49-L. Some Aspects of Tinning by Immersion Processes.** D. E. Weimer and J. W. Price. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 95-108, disc. 109-111.

Tin coatings applied by chemical displacement on aluminum castings. Graphs, tables, 7 ref. (L16, Sn, Al)

**50-L. Organic Protective and Decorative Coatings for Metal Containers.** T. G. Green and M. Thomas. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 112-121, disc., p. 122-123.

Composition properties and application techniques of lacquers for food cans. Diagram, photograph. 8 ref. (L26, Sn)

**51-L. Phosphating.** R. F. Drysdale. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 124-139.

Review of methods, characterization of coatings applied by various techniques. 11 ref. (L14)

**52-L. Stress in Electrodeposits.** R. A. F. Hammond. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 140-157.

Methods of measuring stresses, effects of electroplating variables on development of stresses in deposits. Diagrams, tables, graphs. 21 ref. (L17, Q25)

**53-L. The Future of Electroplating.** William Blum. *Institute of Metal Finishing, Transactions,* v. 30, 1954, p. 182-195, disc., p. 196-201.

Trends and outlook in research, metals to be coated, coating metals, electroplating techniques. (L17)

**54-L. Precious Metal Plating: Uses Expand in Industry.** P. J. Sloane and Isidore Cross. *Iron Age,* v. 176, Nov. 17, 1955, p. 120-123.

Precious metal plating is becoming important in industry as a low-cost method of achieving optimum serviceability. Thin deposits resist wear and retain their surface properties. Diagram, photographs. (L17, EG-c)

**55-L. Coating on Polished Strip Saves Refinishing Costs.** W. G. Patton. *Iron Age,* v. 176, Nov. 24, 1955, p. 83-85.

Spray coating is applied to strip before forming or stamping. Table, photographs. (L26)

**56-L. Chemical and Anodic Treatments.** V. F. Henley. *Light Metals,* v. 18, Nov. 1955, p. 368-369.

Critical review of British patents on chemical and anodic oxidation of aluminum, including after-treatment processes. (L14, L19, Al)

**57-L. Quality Tests for Black Oxide Coatings on Steel.** Jodie Doss. *Metal Finishing,* v. 53, Dec. 1955, p. 48-50, 56.

Thirteen types of steel were black-oxide treated in an aqueous alkaline oxidizing bath for various periods of time. A test using 5% oxalic acid solution was found to indicate the quality of the coating. Micrographs. (L14, S10, ST)

**58-L. The Cr-22 Coating for Magnesium.** Wm. McNeill. *Metal Finishing,* v. 53, Dec. 1955, p. 57-59.

New anodic coating combining short treatment time and low electrolyte coats with excellent protective properties. Micrographs. (L19, Mg)

**59-L. Science for Electroplaters. IX. Solutions—Equations.** L. Serota. *Metal Finishing,* v. 53, Dec. 1955, p. 66-68.

Basic equations. (L17)

**60-L. Corrosion Protection of Magnesium Alloys.** Maurice Hardouin. *Metal Industry,* v. 87, Nov. 4, 1955, p. 385-387.

Review of new methods evaluated alongside older, more conventional methods. Graphs. 3 ref. (To be continued.) (L general, Mg)

**61-L. The Effect of Modifiers on the Chemical Resistance of Vinyl Films.** *Official Digest. Federation of Paint and Varnish Production Clubs,* v. 27, Nov. 1955, p. 828-837.

Coatings of Vinylite VAGH with eight modifications tested on unprimed steel panels in seven different liquid systems. Aroclor 1254 is superior to others used. Graph, tables. (L26, R5, ST)

**62-L. Beverage Can Linings.** E. S. Beck. *Organic Finishing,* v. 16, Nov. 1955, p. 13-20.

Differences and similarities of construction, properties and testing of two can types. Diagram, photographs. (L26)

**63-L. Electrodecontamination of Metals.** John B. Huff. *Phillips Petroleum Co. (U. S. Atomic Energy Commission),* IDO 14352, Aug. 1955, 22 p.

Equipment and process. Photographs. 9 ref. (L13)

**64-L. Now You Can Renew Worn Cylinders With Chromium.** *Power Engineering,* v. 59, Dec. 1955, p. 64-66.

The Van der Horst Corp. has developed a porous chromium finish, as a cylinder lining material, which permits lubrication. Photographs, micrograph, table. (L17, Cr)

**65-L. Zinc Coatings for Protecting Steel.** Ernest W. Horvick. *Product Engineering,* v. 26, Dec. 1955, p. 158-161.

Five methods of applying zinc coatings and advantages or limitations of each. Photographs, tables. (L general, Zn, ST)

**66-L. Brush Plating.** Seymour Senderoff. *Products Finishing,* v. 20, Dec. 1955, p. 52 + 7 pages.

"Dalic" plating process, equipment, methods, applications. Photographs, table, diagram. (L17)

**67-L. Abrasive Blasts Scale From Carbon Strip.** Gilbert D. Dill. *Steel,* v. 137, Nov. 28, 1955, p. 106-107.

Description and operation of line of equipment for cleaning hot rolled carbon steel strip by mechanical blast descaling and short flash-pickle. Photograph, diagram, table. (L10, L12, CN)

**68-L. Cyanide Recovery Pays Double Dividend.** *Steel,* v. 137, Nov. 28, 1955, p. 117, 120.

Recovery of zinc plating solution from rinse water is cheaper than chlorination treatment. Diagram. (L17, A8, Zn)

**69-L. Studies on the Anodic Polarization of Zirconium.** George B. Adams, Jr., Mario Maraghini, Tien-Shuey Lee and Pierre Van Rysselberghe. *University of Oregon (U. S. Atomic Energy Commission),* AECU-3058, July 1955, 35 p.

Studies on formation and properties of anodic oxide coatings on hafnium-free metal. Graphs, tables, circuit diagrams. 11 ref. (L19, Zr)

**70-L. Thermodiffusional Sulfidizing of Steels.** V. V. Gal'chenko. *Henry Brutcher Translation No.* 3595, 9 p. (From *Stanki i instrument,* v. 26, no. 2, 1955, p. 17-19.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 321-L, 1955. (L15, ST)

**71-L. Joining and Finishing of Zirconium. VII. Surface Treatment and Cleaning.** Paul Cohen. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 334-337.

Methods and equipment for vapor blasting and pickling. Tables. (L10, L12, Zr)

**72-L. Joining and Finishing of Zirconium. VIII. Plating.** J. G. Beach. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 337-347.

Preparation of electroplated and hot dip coatings on zirconium and the electrodeposition of zirconium on iron, nickel, molybdenum, titanium or zirconium alloys. Tables, micrographs. 39 ref. (L17, L16, Zr)

**73-L. (French.) The Use of Oil Bitumen for the Protection of Underground Pipes.** E. Leclerc and H. Goldstein. *Industrie Chimique Belge,* v. 20, no. 1, Jan. 1955, p. 19-27.

Characteristics, processes for control, examination of objections against the product. Diagrams. 13 ref. (L26)

**74-L. (French.) Surface Treatment of Aluminum and Its Alloys. I. Mechanical Treatment. Mechanical Polishing.** Charles Etienne and Francois Flusin. *Revue de l'aluminium,* v. 32, no. 224, Sept. 1955, p. 821-830.

Reviews buffing, dabbing, brightening, polishing machines and defects, parts design, alloy selection. Tables, diagrams, photographs. (To be continued.) (L10, Al)

**75-L. (Russian.) Study of Chemically Active Coatings for Raising the Quality of Transformer Steel.** N. I. Lapkin. *Fizika metallov i metallovedenie,* v. 1, no. 1, 1955, p. 185-192.

Composition, concentration, manner of drying potassium, sodium, magnesium and barium carbonate coatings; variation in specific losses, grain size and oxygen content in relation to content of coatings when annealing steel in hydrogen or in vacuum; effect of optimum chemically active coating and annealing temperature on magnetic properties of steel. Graphs, tables. 6 ref. (L14, P16, ST)

**76-L. (Book.) Institute of Metal Finishing, Transactions (Annual Volume),** v. 30, 1954, 207 p. Institute of Metal Finishing, 32, Great Ormond St., London, England.

Reports on organics, hot-dip, electroplate, and chemical coatings are abstracted separately. (L general)

# M

# Metallography, Constitution and Primary Structures

**1-M. The Inner Structure of Alnico 5.** E. A. Nesbitt and R. D. Heidenreich. *Bell Laboratories Record,* v. 33, Nov. 1955, p. 405-409.

New theory in experimental phase may result in more powerful magnets. Photographs, diagrams, graph. (M26, M27, SG-n)

**2-M. Textures in Face-Centered Cubic Metals and Alloys.** R. E. Smallman. *Institute of Metals, Journal,* v. 23, Sept. 1955, p. 10-18.

Results interpreted in terms of solute "atmosphere" locking; predictions of characteristic slip behavior made. Diagrams, graphs. tables. 37 ref. (M26)

**3-M. Electrolytic Polishing Technique for Metallographic Specimens in Routine Quality Control.** P. M. H. Chawner. *Metal Treatment and Drop Forging,* v. 22, Oct. 1955, p. 427-429, 432.

Use of fast-flowing electrolyte, mechanism of electropolishing, use of rotating cathode. Micrographs, diagram, photograph. 5 ref. (M21)

**4-M. Formation of Etch Pits on Slip Lines in Aluminium.** G. Wyon and J. M. Marchin. *Philosophical Magazine,* v. 46, 7th ser., no. 381, Oct. 1955, p. 1119-1122.

Experimental results show that revealing dislocations by micrography in metallic lattices in rarely simple and that it is necessary to perfect etching reagents which are more sensitive, reproducible and selective. 10 ref. (M26, M21, Al)

**5-M. (English.) An Interferometric Study of Grain Boundary Grooves in Tin.** H. Mykura. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 436-441.

Because of specimen shape and method of its support, groove formation, by a mechanism depending on simultaneous grain-boundary sliding and migration, occurred. Micrographs, diagrams. 12 ref. (M27, Sn)

**6-M. (English.) Stacking Faults in Cold Worked Alpha-Brass.** B. E. Warren and E. P. Warekois. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 473-479.

Stacking fault probability increases with increasing zinc content. Tables, graphs. (M26, Cu)

**7-M. (English.) The Lattice Spacings of Close-Packed Hexagonal 3/2 Electron Compounds.** G. V. Raynor and T. B. Massalski. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 480-486.

Spacings in the system copper-gallium-germanium determined as a function of composition and electron atom ratio, using alloys quenched from 550° C. Graphs, table, diagram. 9 ref. (M26, Ge, Ga, Cu)

**8-M. (English.) The Elastic Interaction of Point Defects.** J. D. Eshelby. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 487-490.

Summarizes the known results for interaction when they are idealized as centers of dilation in an isotropic elastic continuum and extends them to the case of cubic anisotropy. 14 ref. (M26)

**9-M. (English.) Plastic Deformation of Copper Crystals Under Alternating Tension and Compression.** M. S. Paterson. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 491-500.

Strain hardening of high-purity single crystals during cycles of reversed plastic strain shown to depend on orientation. Diagrams, graphs, micrographs. 29 ref. (M26, Q24, Cu)

**10-M. (English.) The Influence of Some Alloying Constituents on the Structure of Cast Aluminium.** A. Domony and C. R. Vassel. *Acta Technica Academiae Scientiarum Hungaricae,* v. 12, nos. 1-2, 1955, p. 157-164.

Effect of various alloying elements and impurities on the primary grain size of the cast metal. Titanium surpassed other elements for grain refining and mode of crystallization. Table. 16 ref. (M27, N12, Al)

**11-M. (Russian.) Analogs of Tungsten Bronzes.** E. I. Krylov. *Doklady akademii nauk SSSR,* v. 104, no. 2, Sept. 11, 1955, p. 246-248.

Composition and properties, interplane distances, intensity of lines, parameters of crystal lattices of columbium bronzes. Tables. 4 ref. (M26, Q general, Cu)

**12-M. (Russian.) Contemporary Ideas About the Structure of Alloys in Connection With the Problem of Strength.** I. L. Mirkin. *Metallovedenie i obrabotka metallov,* 1955, no. 1, July, p. 11-18.

Atomic structure and properties of metals; imperfections in crystals and peculiarities of the basic lattice; various types of heat treatment and alloying elements in steels, aluminum, and other metals. 31 ref. (M25, M26, J general, AY, Al, Ni, Ti, Cr)

**13-M. (Russian.) Crystal Structure of the Compounds, $CrBe_{12}$, $VBe_{12}$, and $CbBe_{12}$.** P. I. Kripiakevich and E. I. Gladyshevskii. *Doklady akademii nauk SSSR,* v. 104, no. 1, Sept. 1, 1955, p. 82-84.

Determination of the coordination numbers and interatomic distances in the structures. X-ray study of the powders of these compounds. Tables. 9 ref. (M26, Cr, V, Cb, Be)

**14-M. (Russian.) New Kurnakov-Type Compound, $Fe_3V$, in the Iron-Vanadium System.** I. I. Kornilov and V. S. Mikheev. *Doklady akademii nauk SSSR,* v. 104, no. 1, Sept. 1, 1955, p. 88-90.

Effects of gradual cooling and of long quenching periods, at temperatures below the transformation point, on the distribution of atoms in the

crystal lattice; electrical resistivity, temperature coefficient and hardness of quenched and tempered alloys; composition-property diagrams of alloys of the system. Table, phase diagrams. 3 ref. (M24, M25, Fe, V)

**15-M. Phase Relations in Magnesium-Lithium-Aluminum Alloys.** D. W. Levinson and D. J. McPherson. *American Society for Metals, Transactions*, v. 48, *Preprint No.* 44, 1955, 23 p.

Relations established by metallographic and X-ray diffraction analysis at 400, 300, 200 and 100° C. Verifies existence of ternary phase at approximately the stoichiometry of $MgLiAl_2$. Graphs, diagrams, micrographs, tables. 9 ref. (M24, Mg, Li, Al)

**16-M. The Constitution of Indium-Arsenic-Antimony Alloys.** C. H. Shih and E. A. Peretti. *American Society for Metals, Transactions*, v. 48; *Preprint No.* 45, 1955, 23 p.

Alloys investigated over the entire compositional range by thermal analysis, microscopic and X-ray methods and no ternary compounds were found to exist. Composition and melting points of intermetallic compounds determined. Tables, graphs, micrographs. 9 ref. (M24, In, As, Sb)

**17-M. The Nature of the Thermal Agitation in Crystals.** C. V. Raman. *Indian Academy of Sciences, Proceedings*, v. 42, sec. A, Oct. 1955, p. 163-174.

Determination of nature of atomic movements that constitute thermal agitation in a crystal. (M26, M25)

**18-M. The Constitution of the Titanium-Oxygen Alloys in the Range 0-35 Weight Per Cent Oxygen.** T. H. Schofield and A. E. Bacon. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 47-53 + 2 plates.

Differs from previous work in regard to limits of the phase fields. Diagrams, tables micrographs. 24 ref. (M24, Ti)

**19-M. Non-Destructive Metallography of Plain Carbon Steels.** K. Sachs and J. D. Bunton. *Metallurgia*, v. 52, no. 312, Oct. 1955, p. 205-209.

Chemical polishing enables the effectiveness of heat treatment to be checked with greater certainty than by other means. Photographs, table, micrographs. 2 ref. (M21, J general, CN)

**20-M. Phase Realtions in Mg-Li-Zn Alloys.** A. F. Weinberg, D. W. Levinson and W. Rostoker. *American Society for Metals, Transactions*, v. 48, *Preprint No.* 47, 1955, 23 p.

Study by methods of metallographic thermal and X-ray diffraction analysis, with isothermal sections presented for temperatures of 400, 300, 200 and 100° C. A ternary phase of wide miscibility was identified, but the ternary phase $MgLi_2Zn$ was not found to be an equilibrium phase at any of the temperatures studied. Tables, graphs, micrographs. 6 ref. (M24, Mg, Li, Zn)

**21-M. Compilation of U. S. and U. K. Uranium and Thorium Constitutional Diagrams.** H. A. Saller and F. A. Rough. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-1000, June 1955, 141 p.

Presents 92 binary and ternary systems comprising data from several sources which are correlated with most recent available findings. Phase diagrams. 376 ref. (M24, U, Th)

**22-M. The Scanning Electron Microscope and Its Fields of Application.** K. C. A. Smith and C. W. Oatley. *British Journal of Applied Physics*, v. 6, Nov. 1955, p. 391-399.

Experience with the scanning electron microscope has shown that there are fields of application where this instrument has distinct advantages over the conventional transmission microscope (with or without replicas) and the reflection electron microscope. For example, there are specimens which are too thick to be viewed by direct transmission and which nevertheless do not lend themselves readily to the construction of replicas. Maps. 10 ref. (M21)

**23-M. System Aluminium-Antimony.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 15, Oct. 1955, 3 p.

Includes diagram, table. 7 ref. (M24, Sb, Al)

**24-M. System Aluminium-Iron.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 13, Sept. 1955, 5 p.

Includes diagrams, table. 18 ref. (M24, Fe, Al)

**25-M. System Aluminium-Manganese.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 17, Oct. 1955, 5 p.

Includes diagram, table. 14 ref. (M24, Mn, Al)

**26-M. System Aluminium-Nickel.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 18, Oct. 1955, 5 p.

Includes diagram, table. 11 ref. (M24, Ni, Al)

**27-M. System Aluminium-Tin.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 14, Sept. 1955, 3 p.

Includes diagram, table. 7 ref. (M24, Sn, Al)

**28-M. The Copper-Rich Alloys of the System Copper-Aluminium-Indium.** P. H. Stirling and G. V. Raynor. *Institute of Metals, Journal*, v. 84, Nov. 1955, p. 57-65.

Partial isothermal equilibrium diagrams for eight temperatures between 550 and 720° C. Results discussed in relation to theory of ternary alloys. Diagrams, graphs, tables. 12 ref. (M24, Cu)

**29-M. The Constitution of the Copper-Rich Copper-Gallium-Germanium Alloys.** G. V. Raynor and T. B. Massalski. *Institute of Metals, Journal*, v. 84, Nov. 1955, p. 66-72.

Isothermal equilibrium diagrams have been determined at 725, 625, 550 and 450° C. There is no fundamental difference between the hexagonal phases of limited homogeneity formed in the solid state at electron; atom ratios near 1.5, and those of wide homogeneity range which are stable from room temperature to the melting point. Diagrams. 10 ref. (M24, Cu)

**30-M. Uranium-Chromium System.** A. H. Daane and A. S. Wilson. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1219-1220.

The eutectic-type system has some solid solubility of chromium in gamma and beta uranium. The eutectic occurs at 20 atomic % chromium and melts at 859° C. Micrographs, diagram. (M24, U, Cr)

**31-M. Liquid Metals. II. X-Ray Diffraction by Liquid Mercury and the Distance of Closest Atomic Approach.** Joseph S. Lukesh. William H. Howland, Leo F. Epstein, and Marion D. Powers. *Journal of Chemical Physics*, v. 23, Oct. 1955, p. 1923-1924.

Resolves vapor viscosity value of 3.25 A with the diffraction value of 3.00 A. 14 ref. (M22, Hg)

**32-M. The Structure of Electrodeposited Metals.** Rolf Weil and Harold J. Read. *Metal Finishing*, v. 53, Dec. 1955, p. 60-64.

Nickel deposits. Micrographs. 14 ref. (M26, M27, L18, Ni)

**33-M. Thermal Vibrations of Atoms in Cubic Crystals. I. The Temperature Variation of Thermal Diffuse Scattering of X-Rays by Lead Single Crystals. II. The Amplitude of Atomic Vibrations.** L. Cartz. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 951-967.

Intensity of thermal diffuse scattering of X-rays decreases with temperature increase for scattering near to high order reciprocal lattice points for crystals of low Debye characteristic temperature. The Lindemann relationship between the Debye characteristic temperature and the melting point may also be obtained from a consideration of the temperature variation of thermal diffuse X-ray scattering. Tables, graphs. 49 ref. (M26, M22, Pb)

**34-M. High-Resolution X-Ray Projection Microscopy.** W. C. Nixon. *Royal Society, Proceedings*, v. 232, ser. A, Nov. 22, 1955, p. 475-485 + 1 plate.

X-ray shadow projection microscope has been limited previously to a resolution of 0.5$\mu$. A resolution of 0.1$\mu$ has now been achieved with the same exposure time of 5 min. This has been done by using a very thin gold-leaf X-ray target (0.1$\mu$ thick) to avoid enlargement of the point source of X-rays due to electron scattering in a thick target. Diagram, graphs, micrographs. 29 ref. (M21)

**35-M. Metallography of Aluminum and Its Alloys. Use of Electrolytic Polishing.** P. A. Jacquet. *U. S. National Advisory Committee for Aeronautics, Technical Memorandum* 1384, Nov. 1955, 80 p.

Methods for electropolishing aluminum and aluminum alloys. Description of a commercial electrolytic polishing unit, suitable for micrographic examination of aluminum and its alloys. Photographs, diagrams, micrographs, tables. 34 ref. (M21, Al)

**36-M. Metallography of Zirconium.** H. P. Roth. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 709-732.

Sample preparation, etchants, photography, optical and electron microscopy. Photographs, micrographs. 37 ref. (M21, Zr)

**37-M.** (German.) **Electron Diffraction on Surface of Copper Monocrystals at High Temperature.** Chr. Menzel-Kopp and E. Menzel. *Zeitschrift für Physik*, v. 142, no. 3, 1955, p. 245-258.

Temperature influence on the electron diffraction in the case of reflection or irradiation of crystals. Diagram, graphs, electron diffractograms. 23 ref. (M22, Cu)

**38-M.** (Book.) **Microscopy of Ceramics and Cements, Including Glasses, Slags, and Foundry Sands.** Herbert Insley and Van Derck Fréchette. 286 p. 1955. Academic Press Inc., 125 E. 23rd St., New York, N. Y.

Microscopes and accessories; optical mineralogy; specimen preparation; thermal behavior of materials. (M21, E18)

## N

## Transformations and Resulting Structures

**1-N. Liquidus Curves for Aluminum Cell Electrolyte. I. Cryolite-Alumina.** N. W. F. Phillips, R. H. Singleton and E. A. Hollingshead. *Electro-*

*chemical Society, Journal*, v. 102, Nov. 1955, p. 648-649.

Curves up to 1050° C. and 16% alumina determined by cooling curves and visual examination of cooling melt. Graph. 6 ref. (N12, Al)

**2-N. Studies on Diffusion. I. Diffusion of Radioactive Matter Through Plates.** U. Aswathanarayana and S. Ramamurthy. *Indian Academy of Sciences, Proceedings*, v. 42, sec. A, Aug. 1955, p. 71-76.

Studies plates of different thicknesses as compared to alpha-ray range of radio-nuclei and radioactive matter of different alpha-ray ranges. 15 ref. (To be continued.) (N1)

**3-N. Intermediate Precipitates in Aged Binary Alloys of Aluminum with Cadmium, Indium, or Tin.** J. M. Silcock. *Institute of Metals, Journal*, v. 23, Sept. 1955, p. 19-22.

Aged single crystals of aluminum containing 0.1 wt.-% cadmium, 0.05 wt.-% indium, or 0.05 wt.-% tin, have been examined by monochromatic X-ray methods. Tables. 10 ref. (N7, Al)

**4-N. Metal Whiskers in Automatic Blanket Thermostats.** J. B. Newkirk. *Metal Progress*, v. 68, Nov. 1955, p. 88-90.

Tiny filaments are single crystals growing from the cadmium plating. Diagram, photographs. (N5, M26, Cd)

**5-N. (English.) Self-Diffusion in Dilute Binary Solid Solutions.** R. E. Hoffman, D. Turnbull and E. W. Hart. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 417-424.

Coefficient of self-diffusion of silver measured as function of atom fraction of substitutional solutes lead, copper, aluminum or germanium. Tables, graphs. 15 ref. (N1, Ag, Pb, Cu, Al, Ge)

**6-N. (English.) BiMn "Spire" Growths Induced by a Magnetic Field.** B. W. Roberts. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 425-430.

Columns of highly oriented ferromagnetic bismuth-manganese crystallites have grown out of mixture of molten bismuth and particles of manganese metals. Diagrams, micrographs. 5 ref. (N12, Bi, Mn)

**7-N. (English.) Self-Diffusion of Gold in Gold-Nickel Alloys.** A. D. Kurtz, B. L. Averbach and Morris Cohen. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 442-446.

Rate measured as function of composition and temperature in region of complete solid solubility, using an autoradiographic method to trace gold-198. Diagram, graphs, tables. 10 ref. (N1, Ni, Au)

**8-N. (English.) Marker Movements in Titanium-Molybdenum Diffusion Couples and the Zener Theory of $D_o$.** P. G. Shewmon and J. H. Bechtold. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 452-455.

Anomalies leading to prediction of ring mechanism discussed; an alternative explanation, consistent with a vacancy mechanism, given. Table, graph. 12 ref. (N1, Ti, Mo)

**9-N. (English.) Diffusion and Solubility of Nitrogen in Silicon-Iron.** D. A. Leak, W. R. Thomas and G. M. Leak. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 501-507.

Peaks corresponding to jumps of interstitial nitrogen atoms are connected with sites either identical with those in pure alpha-iron or in octahedra containing one silicon atom along tetrad axis. Graphs, tables, diagram. 21 ref. (N1, N12, Fe, Si, N)

**10-N. (German.) Crystallization of Antimony Deposited by Evaporation.** Adolf Götzberger. *Zeitschrift für Physik*, v. 142, no. 2, 1955, p. 182-200.

Experimental investigation of crystallization mechanism in fine layers of antimony made by different methods and resulting data. Photographs, graph, diagrams. 11 ref. (N12, L25, Sb)

**11-N. (Russian.) Stabilization of Residual Austenite of High-Speed and High-Chromium Steels Against Tempering.** Iu. A. Geller and R. P. Leshchinskaia. *Metallovedenie i obrabotka metallov*, 1955, no. 1, July, p. 26-33.

Importance of stabilization against tempering for steels whose tempering would cause martensitic transformation. Stabilization is achieved through soaking, low tempering (not causing martensitic transformation), or by increasing the chromium content in austenite. Graphs, table. 11 ref. (N8, AY, TS)

**12-N. (Russian.) Investigation of the Third Transformation in the Tempering of Steel.** A. P. Guliaev and N. I. Burova. *Metallovedenie i obrabotka metallov*, 1955, no. 1, July, p. 40-46.

The "third transformation" during tempering is not associated with carbide transformation, since it is found in carbon-free iron-manganese alloys and technical iron, and, in both cases, the carbide phase is absent. Cooling in liquid nitrogen increases the effect of this transformation, even in steels where the residual austenite was absent after quenching. X-ray analysis reveals that in the temperature range of the transformation, there is a considerable decrease of second order stresses. Graphs. 8 ref. (N8, AY)

**13-N. Metallographic Study of Sodium, Potassium, Rubidium, and Caesium After Cooling to 1.2° K.** Charles S. Barrett. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 43-46 + 1 plate.

Search for martensitic transformations. Diagram, micrographs. 11 ref. (N9, Na, K, Rb, Cs)

**14-N. Relaxation of the Precipitated Copper Atoms in the Binary Alloy AuCu.** R. Kamel. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 55-56.

Study of the kinetics of ordering in the gold-copper system. Diagrams. 6 ref. (N10, Au, Cu)

**15-N. Theory of Crystal Growth.** I. V. Salli. *Henry Brutcher Translation No.* 3546, 13 p. (Abridged from *Zhurnal eksper. i teoret. fiziki*, v. 25, no. 2 (8), 1953, p. 208-214.) Henry Brutcher, Altadena, Calif.

Correlates growth of crystals during isothermal crystallization. Explanation of effect of inoculants or ultrasound in the light of these correlations. Graph, diagrams. 5 ref. (N12)

**16-N. (Czech.) Isothermal Decomposition of Austenite in Tungsten-Alloyed Steels. I. Effect of Tungsten Upon the Isothermal Decomposition of Austenite in the Steel 25 MnCrV.** Josef Cadek. *Hutnicke listy*, v. 10, no. 10, Oct. 1955, p. 587-595 + 2 plates.

Tungsten influence, studied metallographically, thermomagnetometrically and by X-ray analysis of the electrolytically isolated carbide phase, shows that it increases the stability of austenite in the ferritic-pearlitic sphere and slightly increases it in the bainitic sphere. In four steels tested, carbide precipitated in the hypo-eutectoid ferrite. Graphs, photographs, tables. 10 ref. (N8, AY)

**17-N. (Czech.) Study of the Effect of Tungsten on the Rate of Nucleus Formation and on Velocity of Ferrite Growth.** Karel Mazanec and Ales Kalivoda. *Hutnické listy*, v. 10, no. 10, Oct. 1955, p. 580-587.

Effect of tungsten, in two structural chromium-tungsten-vanadium steel crystallizations, caused both crystallization parameters to decrease in the temperature ranges of 650 to 740° C., and also reduced carbon diffusion in austenite. Graphs, tables, micrographs. 19 ref. (N8, Fe)

**18-N. (Russian.) Possible Formation of Supersaturated Solid Solution in Aluminum Alloys by Quenching Their Liquid State.** I. N. Fridliander. *Doklady akademii nauk SSSR*, v. 104, no. 3, Sept. 21, 1955, p. 429-432.

Effect of concentration and heat treatment on electrical resistivity and its temperature coefficient of aluminum-manganese alloys. Change of crystal lattice after various types of heat treatment; shift of liquidus lines, eutectics and peritectics in aluminum-manganese alloys crystallizing at rapid rate of cooling. Graphs. 8 ref. (N12, P15, Al)

**19-N. (Russian.) Redistribution of Carbon at the Separation Surface of Heterogeneous Micro-Areas of Steel During Tempering.** S. F. Iur'ev and B. I. Bruk. *Doklady akademii nauk SSSR*, v. 104, no. 4, Oct. 1, 1955, p. 533-536.

Diffusion of carbon at fusion boundary at various tempering temperatures and without tempering; heterogeneity of steel as a result of quenching, and the appearance of "heterogeneous contact" surface of different phases (austenitic, martensitic, ferritic and carbide). Role of carbide-forming elements, chromium and manganese, along boundaries of austenitic grains. Micrographs, graphs. 1 ref. (N1, N8, J29, ST)

**20-N. (Russian.) Phase Transformations in Steel With Rapid Electrical Heating.** A. P. Guliaev and V. M. Zalkin. *Metallovedenie i obrabotka mettallov*, 1955, no. 2, Aug., p. 15-20.

Transformation kinetic curves of pearlite to austenite during continuous heating; effect of heating rate on transformation; kinetics of isothermal transformation. Graphs. 6 ref. (N8, J22, AY)

**21-N. (Russian.) Isothermal Transformation of Austenite in Heat Resistant Steel.** R. P. Zaletaeva. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 25-28.

Relation of variation in hardness to temperature and duration of isothermal soaking. Mechanical properties in relation to various quench and temper regimes. Graphs, table. (N8, J26, J29, Q general, SS)

**22-N. (Russian.) Basic Physical Factors of Crystallization.** V. N. Danilov. *Stal'*, v. 15, no. 10, Oct. 1955, p. 909-913.

Contemporary theories of generation of crystallization centers and of crystal growth in connection with consecutive crystallization of a steel casting and the role of heat elimination. Influence of cooling regime and various impurities on crystallization kinetics in cast steel. Graphs. 5 ref. (N12, CI)

**23-N. The Diffusion of Interstitial and Substitutional Elements in Titanium.** J. E. Reynolds and R. I. Jaffee. *Battelle Memorial Institute, Titanium Metallurgical Laboratory Report No.* 21, Oct. 1955, 12 p.

Self-diffusion has not been determined, but activation energy has been estimated to be 77,000 cal. per mol. Review of available diffusion data and uses of diffusion data in general. Graph, tables. 25 ref. (N1, Ti)

**24-N. Hydrogen in Steel.** E. G. Ford, W. G. Linkert and N. A. Graham. *Chemistry in Canada*, v. 7, Nov. 1955, p. 31-35.

Trouble with blistering of a steel-backed babbitt thrust bearing

crystal lattice; electrical resistivity, temperature coefficient and hardness of quenched and tempered alloys; composition-property diagrams of alloys of the system. Table, phase diagrams. 3 ref. (M24, M25, Fe, V)

**15-M. Phase Relations in Magnesium-Lithium-Aluminum Alloys.** D. W. Levinson and D. J. McPherson. *American Society for Metals, Transactions*, v. 48, *Preprint No.* 44, 1955, 23 p.

Relations established by metallographic and X-ray diffraction analysis at 400, 300, 200 and 100° C. Verifies existence of ternary phase at approximately the stoichiometry of $MgLiAl_2$. Graphs, diagrams, micrographs, tables. 9 ref. (M24, Mg, Li, Al)

**16-M. The Constitution of Indium-Arsenic-Antimony Alloys.** C. H. Shih and E. A. Peretti. *American Society for Metals, Transactions*, v. 48; *Preprint No.* 45, 1955, 23 p.

Alloys investigated over the entire compositional range by thermal analysis, microscopic and X-ray methods and no ternary compounds were found to exist. Composition and melting points of intermetallic compounds determined. Tables, graphs, micrographs. 9 ref. (M24, In, As, Sb)

**17-M. The Nature of the Thermal Agitation in Crystals.** C. V. Raman. *Indian Academy of Sciences, Proceedings*, v. 42, sec. A, Oct. 1955, p. 163-174.

Determination of nature of atomic movements that constitute thermal agitation in a crystal. (M26, M25)

**18-M. The Constitution of the Titanium-Oxygen Alloys in the Range 0-35 Weight Per Cent Oxygen.** T. H. Schofield and A. E. Bacon. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 47-53 + 2 plates.

Differs from previous work in regard to limits of the phase fields. Diagrams, tables micrographs. 24 ref. (M24, Ti)

**19-M. Non-Destructive Metallography of Plain Carbon Steels.** K. Sachs and J. D. Bunton. *Metallurgia*, v. 52, no. 312, Oct. 1955, p. 205-209.

Chemical polishing enables the effectiveness of heat treatment to be checked with greater certainty than by other means. Photographs, table, micrographs. 2 ref. (M21, J general, CN)

**20-M. Phase Realtions in Mg-Li-Zn Alloys.** A. F. Weinberg, D. W. Levinson and W. Rostoker. *American Society for Metals, Transactions*, v. 48, *Preprint No.* 47, 1955, 23 p.

Study by methods of metallographic thermal and X-ray diffraction analysis, with isothermal sections presented for temperatures of 400, 300, 200 and 100° C. A ternary phase of wide miscibility was identified, but the ternary phase $MgLi_2Zn$ was not found to be an equilibrium phase at any of the temperatures studied. Tables, graphs, micrographs. 6 ref. (M24, Mg, Li, Zn)

**21-M. Compilation of U. S. and U. K. Uranium and Thorium Constitutional Diagrams.** H. A. Saller and F. A. Rough. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-1000, June 1955, 141 p.

Presents 92 binary and ternary systems comprising data from several sources which are correlated with most recent available findings. Phase diagrams. 376 ref. (M24, U, Th)

**22-M. The Scanning Electron Microscope and Its Fields of Application.** K. C. A. Smith and C. W. Oatley. *British Journal of Applied Physics*, v. 6, Nov. 1955, p. 391-399.

Experience with the scanning electron microscope has shown that there are fields of application where this instrument has distinct advantages over the conventional transmission microscope (with or without replicas) and the reflection electron microscope. For example, there are specimens which are too thick to be viewed by direct transmission and which nevertheless do not lend themselves readily to the construction of replicas. Maps. 10 ref. (M21)

**23-M. System Aluminium-Antimony.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 15, Oct. 1955, 3 p.

Includes diagram, table. 7 ref. (M24, Sb, Al)

**24-M. System Aluminium-Iron.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 13, Sept. 1955, 5 p.

Includes diagrams, table. 18 ref. (M24, Fe, Al)

**25-M. System Aluminium-Manganese.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 17, Oct. 1955, 5 p.

Includes diagram, table. 14 ref. (M24, Mn, Al)

**26-M. System Aluminium-Nickel.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 18, Oct. 1955, 5 p.

Includes diagram, table. 11 ref. (M24, Ni, Al)

**27-M. System Aluminium-Tin.** H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 14, Sept. 1955, 3 p.

Includes diagram, table. 7 ref. (M24, Sn, Al)

**28-M. The Copper-Rich Alloys of the System Copper-Aluminium-Indium.** P. H. Stirling and G. V. Raynor. *Institute of Metals, Journal*, v. 84, Nov. 1955, p. 57-65.

Partial isothermal equilibrium diagrams for eight temperatures between 550 and 720° C. Results discussed in relation to theory of ternary alloys. Diagrams, graphs, tables. 12 ref. (M24, Cu)

**29-M. The Constitution of the Copper-Rich Copper-Gallium-Germanium Alloys.** G. V. Raynor and T. B. Massalski. *Institute of Metals, Journal*, v. 84, Nov. 1955, p. 66-72.

Isothermal equilibrium diagrams have been determined at 725, 625, 550 and 450° C. There is no fundamental difference between the hexagonal phases of limited homogeneity formed in the solid state at electron; atom ratios near 1.5, and those of wide homogeneity range which are stable from room temperature to the melting point. Diagrams. 10 ref. (M24, Cu)

**30-M. Uranium-Chromium System.** A. H. Daane and A. S. Wilson. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1219-1220.

The eutectic-type system has some solid solubility of chromium in gamma and beta uranium. The eutectic occurs at 20 atomic % chromium and melts at 859° C. Micrographs, diagram. (M24, U, Cr)

**31-M. Liquid Metals. II. X-Ray Diffraction by Liquid Mercury and the Distance of Closest Atomic Approach.** Joseph S. Lukesh. William H. Howland, Leo F. Epstein, and Marion D. Powers. *Journal of Chemical Physics*, v. 23, Oct. 1955, p. 1923-1924.

Resolves vapor viscosity value of 3.25 A with the diffraction value of 3.00 A. 14 ref. (M22, Hg)

**32-M. The Structure of Electrodeposited Metals.** Rolf Weil and Harold J. Read. *Metal Finishing*, v. 53, Dec. 1955, p. 60-64.

Nickel deposits. Micrographs. 14 ref. (M26, M27, L18, Ni)

**33-M. Thermal Vibrations of Atoms in Cubic Crystals. I. The Temperature Variation of Thermal Diffuse Scattering of X-Rays by Lead Single Crystals. II. The Amplitude of Atomic Vibrations.** L. Cartz. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 951-967.

Intensity of thermal diffuse scattering of X-rays decreases with temperature increase for scattering near to high order reciprocal lattice points for crystals of low Debye characteristic temperature. The Lindemann relationship between the Debye characteristic temperature and the melting point may also be obtained from a consideration of the temperature variation of thermal diffuse X-ray scattering. Tables, graphs. 49 ref. (M26, M22, Pb)

**34-M. High-Resolution X-Ray Projection Microscopy.** W. C. Nixon. *Royal Society, Proceedings*, v. 232, ser. A, Nov. 22, 1955, p. 475-485 + 1 plate.

X-ray shadow projection microscope has been limited previously to a resolution of 0.5$\mu$. A resolution of 0.1$\mu$ has now been achieved with the same exposure time of 5 min. This has been done by using a very thin gold-leaf X-ray target (0.1$\mu$ thick) to avoid enlargement of the point source of X-rays due to electron scattering in a thick target. Diagram, graphs, micrographs. 29 ref. (M21)

**35-M. Metallography of Aluminum and Its Alloys. Use of Electrolytic Polishing.** P. A. Jacquet. *U. S. National Advisory Committee for Aeronautics, Technical Memorandum* 1384, Nov. 1955, 80 p.

Methods for electropolishing aluminum and aluminum alloys. Description of a commercial electrolytic polishing unit, suitable for micrographic examination of aluminum and its alloys. Photographs, diagrams, micrographs, tables. 34 ref. (M21, Al)

**36-M. Metallography of Zirconium.** H. P. Roth. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 709-732.

Sample preparation, etchants, photography, optical and electron microscopy. Photographs, micrographs. 37 ref. (M21, Zr)

**37-M.** (German.) **Electron Diffraction on Surface of Copper Monocrystals at High Temperature.** Chr. Menzel-Kopp and E. Menzel. *Zeitschrift für Physik*, v. 142, no. 3, 1955, p. 245-258.

Temperature influence on the electron diffraction in the case of reflection or irradiation of crystals. Diagram, graphs, electron diffractograms. 23 ref. (M22, Cu)

**38-M.** (Book.) **Microscopy of Ceramics and Cements, Including Glasses, Slags, and Foundry Sands.** Herbert Insley and Van Derck Fréchette. 286 p. 1955. Academic Press Inc., 125 E. 23rd St., New York, N. Y.

Microscopes and accessories; optical mineralogy; specimen preparation; thermal behavior of materials. (M21, E18)

## N

## Transformations and Resulting Structures

**1-N. Liquidus Curves for Aluminum Cell Electrolyte. I. Cryolite-Alumina.** N. W. F. Phillips, R. H. Singleton and E. A. Hollingshead. *Electro-*

*chemical Society, Journal*, v. 102, Nov. 1955, p. 648-649.

Curves up to 1050° C. and 16% alumina determined by cooling curves and visual examination of cooling melt. Graph. 6 ref. (N12, Al)

**2-N. Studies on Diffusion. I. Diffusion of Radioactive Matter Through Plates.** U. Aswathanarayana and S. Ramamurthy. *Indian Academy of Sciences, Proceedings*, v. 42, sec. A, Aug. 1955, p. 71-76.

Studies plates of different thicknesses as compared to alpha-ray range of radio-nuclei and radioactive matter of different alpha-ray ranges. 15 ref. (To be continued.) (N1)

**3-N. Intermediate Precipitates in Aged Binary Alloys of Aluminum with Cadmium, Indium, or Tin.** J. M. Silcock. *Institute of Metals, Journal*, v. 23, Sept. 1955, p. 19-22.

Aged single crystals of aluminum containing 0.1 wt.-% cadmium, 0.05 wt.-% indium, or 0.05 wt.-% tin, have been examined by monochromatic X-ray methods. Tables. 10 ref. (N7, Al)

**4-N. Metal Whiskers in Automatic Blanket Thermostats.** J. B. Newkirk. *Metal Progress*, v. 68, Nov. 1955, p. 88-90.

Tiny filaments are single crystals growing from the cadmium plating. Diagram, photographs. (N5, M26, Cd)

**5-N. (English.) Self-Diffusion in Dilute Binary Solid Solutions.** R. E. Hoffman, D. Turnbull and E. W. Hart. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 417-424.

Coefficient of self-diffusion of silver measured as function of atom fraction of substitutional solutes lead, copper, aluminum or germanium. Tables, graphs. 15 ref. (N1, Ag, Pb, Cu, Al, Ge)

**6-N. (English.) BiMn "Spire" Growths Induced by a Magnetic Field.** B. W. Roberts. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 425-430.

Columns of highly oriented ferromagnetic bismuth-manganese crystallites have grown out of mixture of molten bismuth and particles of manganese metals. Diagrams, micrographs. 5 ref. (N12, Bi, Mn)

**7-N. (English.) Self-Diffusion of Gold in Gold-Nickel Alloys.** A. D. Kurtz, B. L. Averbach and Morris Cohen. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 442-446.

Rate measured as function of composition and temperature in region of complete solid solubility, using an autoradiographic method to trace gold-198. Diagram, graphs, tables. 10 ref. (N1, Ni, Au)

**8-N. (English.) Marker Movements in Titanium-Molybdenum Diffusion Couples and the Zener Theory of $D_0$.** P. G. Shewmon and J. H. Bechtold. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 452-455.

Anomalies leading to prediction of ring mechanism discussed; an alternative explanation, consistent with a vacancy mechanism, given. Table, graph. 12 ref. (N1, Ti, Mo)

**9-N. (English.) Diffusion and Solubility of Nitrogen in Silicon-Iron.** D. A. Leak, W. R. Thomas and G. M. Leak. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 501-507.

Peaks corresponding to jumps of interstitial nitrogen atoms are connected with sites either identical with those in pure alpha-iron or in octahedra containing one silicon atom along tetrad axis. Graphs, tables, diagram. 21 ref. (N1, N12, Fe, Si, N)

**10-N. (German.) Crystallization of Antimony Deposited by Evaporation.** Adolf Götzberger. *Zeitschrift für Physik*, v. 142, no. 2, 1955, p. 182-200.

Experimental investigation of crystallization mechanism in fine layers of antimony made by different methods and resulting data. Photographs, graph, diagrams. 11 ref. (N12, L25, Sb)

**11-N. (Russian.) Stabilization of Residual Austenite of High-Speed and High-Chromium Steels Against Tempering.** Iu. A. Geller and R. P. Leshchinskaia. *Metallovedenie i obrabotka metallov*, 1955, no. 1, July, p. 26-33.

Importance of stabilization against tempering for steels whose tempering would cause martensitic transformation. Stabilization is achieved through soaking, low tempering (not causing martensitic transformation), or by increasing the chromium content in austenite. Graphs, table. 11 ref. (N8, AY, TS)

**12-N. (Russian.) Investigation of the Third Transformation in the Tempering of Steel.** A. P. Guliaev and N. I. Burova. *Metallovedenie i obrabotka metallov*, 1955, no. 1, July, p. 40-46.

The "third transformation" during tempering is not associated with carbide transformation, since it is found in carbon-free iron-manganese alloys and technical iron, and, in both cases, the carbide phase is absent. Cooling in liquid nitrogen increases the effect of this transformation, even in steels where the residual austenite was absent after quenching. X-ray analysis reveals that in the temperature range of the transformation, there is a considerable decrease of second order stresses. Graphs. 8 ref. (N8, AY)

**13-N. Metallographic Study of Sodium, Potassium, Rubidium, and Caesium After Cooling to 1.2° K.** Charles S. Barrett. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 43-46 + 1 plate.

Search for martensitic transformations. Diagram, micrographs. 11 ref. (N9, Na, K, Rb, Cs)

**14-N. Relaxation of the Precipitated Copper Atoms in the Binary Alloy AuCu.** R. Kamel. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 55-56.

Study of the kinetics of ordering in the gold-copper system. Diagrams. 6 ref. (N10, Au, Cu)

**15-N. Theory of Crystal Growth.** I. V. Salli. *Henry Brutcher Translation No.* 3546, 13 p. (Abridged from *Zhurnal eksper. i teoret. fiziki*, v. 25, no. 2 (8), 1953, p. 208-214.) Henry Brutcher, Altadena, Calif.

Correlates growth of crystals during isothermal crystallization. Explanation of effect of inoculants or ultrasound in the light of these correlations. Graph, diagrams. 5 ref. (N12)

**16-N. (Czech.) Isothermal Decomposition of Austenite in Tungsten-Alloyed Steels. I. Effect of Tungsten Upon the Isothermal Decomposition of Austenite in the Steel 25 MnCrV.** Josef Cadek. *Hutnicke listy*, v. 10, no. 10, Oct. 1955, p. 587-595 + 2 plates.

Tungsten influence, studied metallographically, thermomagnetometrically and by X-ray analysis of the electrolytically isolated carbide phase, shows that it increases the stability of austenite in the ferritic-pearlitic sphere and slightly increases it in the bainitic sphere. In four steels tested, carbide precipitated in the hypo-eutectoid ferrite. Graphs, photographs, tables. 10 ref. (N8, AY)

**17-N. (Czech.) Study of the Effect of Tungsten on the Rate of Nucleus Formation and on Velocity of Ferrite Growth.** Karel Mazanec and Ales Kalivoda. *Hutnické listy*, v. 10, no. 10, Oct. 1955, p. 580-587.

Effect of tungsten, in two structural chromium-tungsten-vanadium steel crystallizations, caused both crystallization parameters to decrease in the temperature ranges of 650 to 740° C., and also reduced carbon diffusion in austenite. Graphs, tables, micrographs. 19 ref. (N8, Fe)

**18-N. (Russian.) Possible Formation of Supersaturated Solid Solution in Aluminum Alloys by Quenching Their Liquid State.** I. N. Fridliander. *Doklady akademii nauk SSSR*, v. 104, no. 3, Sept. 21, 1955, p. 429-432.

Effect of concentration and heat treatment on electrical resistivity and its temperature coefficient of aluminum-manganese alloys. Change of crystal lattice after various types of heat treatment; shift of liquidus lines, eutectics and peritectics in aluminum-manganese alloys crystallizing at rapid rate of cooling. Graphs. 8 ref. (N12, P15, Al)

**19-N. (Russian.) Redistribution of Carbon at the Separation Surface of Heterogeneous Micro-Areas of Steel During Tempering.** S. F. Iur'ev and B. I. Bruk. *Doklady akademii nauk SSSR*, v. 104, no. 4, Oct. 1, 1955, p. 533-536.

Diffusion of carbon at fusion boundary at various tempering temperatures and without tempering; heterogeneity of steel as a result of quenching, and the appearance of "heterogeneous contact" surface of different phases (austenitic, martensitic, ferritic and carbide). Role of carbide-forming elements, chromium and manganese, along boundaries of austenitic grains. Micrographs, graphs. 1 ref. (N1, N8, J29, ST)

**20-N. (Russian.) Phase Transformations in Steel With Rapid Electrical Heating.** A. P. Guliaev and V. M. Zalkin. *Metallovedenie i obrabotka mettallov*, 1955, no. 2, Aug., p. 15-20.

Transformation kinetic curves of pearlite to austenite during continuous heating; effect of heating rate on transformation; kinetics of isothermal transformation. Graphs. 6 ref. (N8, J22, AY)

**21-N. (Russian.) Isothermal Transformation of Austenite in Heat Resistant Steel.** R. P. Zaletaeva. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 25-28.

Relation of variation in hardness to temperature and duration of isothermal soaking. Mechanical properties in relation to various quench and temper regimes. Graphs, table. (N8, J26, J29, Q general, SS)

**22-N. (Russian.) Basic Physical Factors of Crystallization.** V. N. Danilov. *Stal'*, v. 15, no. 10, Oct. 1955, p. 909-913.

Contemporary theories of generation of crystallization centers and of crystal growth in connection with consecutive crystallization of a steel casting and the role of heat elimination. Influence of cooling regime and various impurities on crystallization kinetics in cast steel. Graphs. 5 ref. (N12, CI)

**23-N. The Diffusion of Interstitial and Substitutional Elements in Titanium.** J. E. Reynolds and R. I. Jaffee. *Battelle Memorial Institute, Titanium Metallurgical Laboratory Report No.* 21, Oct. 1955, 12 p.

Self-diffusion has not been determined, but activation energy has been estimated to be 77,000 cal. per mol. Review of available diffusion data and uses of diffusion data in general. Graph, tables. 25 ref. (N1, Ti)

**24-N. Hydrogen in Steel.** E. G. Ford, W. G. Linkert and N. A. Graham. *Chemistry in Canada*, v. 7, Nov. 1955, p. 31-35.

Trouble with blistering of a steel-backed babbitt thrust bearing

caused by hydrogen diffusion prompted study; prolonged heat treatment offers only relief. Diagrams, graphs, photographs, table. 20 ref. (N1, J23, CN)

**25-N. Widmanstätten and Other Abnormal Graphite Forms in Cast Iron.** E. Bull Simonsen and Floyd Brown. *Foundry Trade Journal*, v. 99, Nov. 3, 1955, p. 499-505; disc., 505-509.

Appearance and condition of formation of a number of abnormal graphite forms in gray cast iron associated with impaired mechanical properties. Graphs, micrographs. 8 ref. (N8, Q general, CI)

**26-N. Small-Angle X-Ray Scattering From Precipitates in Cold-Worked Al-Ag and Al-Zn.** J. P. Jan. *Journal of Applied Physics*, v. 26, Nov. 1955, p. 1291-1296.

Study of aging. Diagrams, graphs, tables. 25 ref. (N7, M22, Al)

**27-N. Transformation Kinetics in Uranium-Chromium Alloys.** D. W. White, Jr. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1221-1228.

Kinetics of isothermal transformation of beta-to-alpha uranium studied over a broad temperature range in alloys containing from 0.3 to 4.0 atomic % chromium. Graphs. 15 ref. (N6, U, Cr)

**28-N. Compositional Changes of the Alpha Phase in a Eutectoid Cu-Al Alloy During Isothermal Transformation.** Daniel F. Toner, Paul E. Gage and David J. Mack. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1228-1230.

Includes graphs. 7 ref. (N9, Cu, Al)

**29-N. Aging Effects in Commercially Pure Beryllium.** D. R. Mash. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1235-1240.

Beryllium samples responded to heat, quench and strain aging treatments. Possible means of obtaining increased normal temperature mechanical properties suggested. Graphs, tables. 4 ref. (N7, Q general Be)

**30-N. Recrystallization Textures of a Cold-Rolled Aluminum Single Crystal.** Y. C. Liu and W. R. Hibbard, Jr. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1249-1251.

A cold rolled aluminium single crystal essentially retains its initial orientation after 99.6% reduction in thickness. Orientation of recrystallized grains described in terms of crystallographic rotations about principal poles of deformation texture. Diagrams. 8 ref. (N5, Q24, Al)

**31-N. Fundamentals of Cold Working and Recrystallization.** B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford and C. Houska. *Massachusetts Institute of Technology (U. S. Atomic Enery Commission)*, NYO-7075, June 1955, 3 p.

An X-ray study of recovery and recrystallization in an alloy containing 75% gold, 25% silver was combined with calorimetric data to obtain pertinent information on mechanism by which energy is stored in deformed metals. (N5, Q24, Au, Ag)

**32-N. Peritectic Reactions in Ternary Metal Systems.** A. Prince. *Metal Treatment and Drop Forging*, v. 22, Nov. 1955, p. 485-489, 34 (adv.)

Includes diagrams. 3 ref. (N12, M24)

**33-N. Impurity Difusion in Crystals (Mainly Ionic Crystals With the Sodium Chloride Structure).** A. B. Lidiard. *Philosophical Magazine*, v. 46, 7th ser., no. 382, Nov. 1955, p. 1218-1235.

Elementary lattice kinetic theory is applied to the problem of impurity diffusion by the vacancy mechanism. Experimental determinations of impurity diffusion coefficients throw a direct light on conditions existing within systems of interest in the field of color centers. Diagrams, graph. 19 ref. (N1, M26, Na)

**34-N. Growth of Oriented Square Zinc Monocrystals.** John J. Gilman and V. J. DeCarlo. *Review of Scientific Instruments*, v. 26, Nov. 1955, p. 1079-1080.

Method consists of two steps; first, cylindrical rods with specific orientations are made for subsequent use as seeds; then, square crystals are seeded in precision Pyrex tubes that have square cross sections. Diagram. (N12, Zn)

**35-N. Changes in the Intensities of X-Ray Diffraction Lines During the Aging of a Ni-Cr-Ti-Al Alloy.** G. V. Kurdyumov and N. T. Travina. *Henry Brutcher Translation No.* 3575, 10 p. (Abridged from *Zhurnal tekhnicheskoi fiziki*, v. 25, no. 2, 1955, p. 182-187.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 163-N, 1955. (N7, M22, Ni, Cr, Ti, Al)

**36-N. Study of Transgranular and Grain-Boundary Diffusion of Metals by Autoradiography.** S. Z. Bokshtein, S. T. Kishkin, L. M. Moroz and T. I. Gudkova. *Henry Brutcher Translation No.* 3590, 6 p. (From *Doklady akademii nauk SSSR*, v. 102, no. 1, 1955, p. 73-75.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 259-N, 1955. (N1, N12, M23, Pb, Fe, Ni)

**37-N. (French.) Thermo-Electric Study of the Transformations of Iron-Chromium Alloys.** Gilles Pomey and Jean Philibert. *Comptes rendus*, v. 241, no. 14, Oct. 3, 1955, p. 877-879.

Measuring the thermo-electric power makes it possible to follow the evolution of iron-chromium alloys close to equiatomic composition and to distinguish the order-disorder and alpha ≷ sigma transformations. Graphs. 2 ref. (N10, Fe, Cr)

**38-N. (German.) Effect of Austenitizing Temperature on the Behavior of Structural Steels During Transformation and Hardening.** Adolf Rose and Werner Strassburg. *Stahl und Eisen*, v. 75, no. 22, Nov. 3, 1955, p. 1472-1480.

Effect of austenitizing temperature on critical behavior in the pearlitic and bainitic stage and characteristic hardenability values. Hardenability is improved with the increasing austenitizing temperature of steels containing alloying elements that form special carbides. Graphs, tables. 10 ref. (N8, J22, J26, AY)

**39-N. (Russian.) Effect of Electrical Heating on Phase Transformations in Carbon and Chromium Steels.** I. E. Kontorovich and A. G. Vinitskii. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 21-25.

Effect of rate of heating on transformation temperature and resulting pearlitic and sorbitic structures; effect of temperature and rate of electrical heating on transformation time; change of hardness and electrical resistivity in relation to temperature and rate of heating; effect of chromium in carbon steel on transformation temperature and time. Graphs, tables. 2 ref. (N8, AY)

# P

# Physical Properties and Test Methods

**1-P. The Enthalpy and Heat Capacity of Magnesium and of Type 430 Stainless Steel From 700 to 1100° K.** Daniel R. Stull and Richard A. McDonald. *American Chemical Society, Journal*, v. 77, Oct. 20, 1955, p. 5293.

Measurements in dropping calorimeter. Tables, graphs, equations. 3 ref. (P12, SS, Mg)

**2-P. The Vapor Pressure of Rhenium.** E. M. Sherwood, D. M. Rosenbaum, J. M. Blocher, Jr., and I. E. Campbell. *Electrochemical Society, Journal*, v. 102, Nov. 1955, p. 650-654.

Determination made over the temperature range of 2220 to 2725° C. Estimates made of its boiling point and of vapor pressure of liquid rhenium. Photograph, micrograph, tables, graph. 11 ref. (P12, Rh)

**3-P. A Study of Transparent, Highly Conducting Gold Films.** E. J. Gillham, J. S. Preston and Betty E. Williams. *Philosophical Magazine*, v. 46, 7th ser., no. 381, Oct. 1955, p. 1051-1068.

On bismuth oxide they show high electrical conductivity and optical transmission; possible use is as transparent coatings for de-icing aircraft windows by direct electrical heating. Tables, graph. 14 ref. (P15, P17, T24, Au, Bi)

**4-P. Ultrasonic Attenuation in Metals.** A. B. Pippard. *Philosophical Magazine*, v. 46, 7th ser., no. 381, Oct. 1955, p. 1104-1114.

Analyzed in terms of free-electron model of metal. 9 ref. (P10)

**5-P. Thermodynamics of a Sheared Superconductor.** A. B. Pippard. *Philosophical Magazine*, v. 46, 7th ser., no. 381, Oct. 1955, p. 1115-1118.

Carried out by torsion measurements on polycrystalline samples, work shows that rigidity modulus differs in normal and superconducting states of tin by an amount which varies with temperature. Diagram. 3 ref. (P12, Sn)

**6-P. (English.) On the Origin of Magnetic Anisotropy Induced by Magnetic Annealing.** Soshin Chikazumi and Tatsuro Oomura. *Physical Society of Japan, Journal*, v. 10, no. 10, Oct. 1955, p. 842-849.

Anistropy occurs if dipole-dipole interaction differs with different sorts of atomic pairs. Table, graphs. 14 ref. (P16, J23, Fe, Ni)

**7-P. (English.) Activity of Aluminum in Liquid Ag-Al, Fe-Al, Fe-Al-C, and Fe-Al-C-Si Alloys.** J. Chipman and T. P. Floridis. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 456-457.

Experimental data on distribution of aluminum between liquid iron and silver at 1600° C. are presented; effects of carbon and silicon in iron. Graphs, tables. 8 ref. (P12, Fe, Al)

**8-P. (English.) The Magnetic Properties and Phase Diagram of Iron Tellurium System.** Shoko Chiba. *Physical Society of Japan, Journal*, v. 10, no. 10, Oct. 1955, p. 837-842.

Thermal analysis and X-ray showed that many intermetallic compounds are formed from melt through peritectic reactions, and an eutectoid reaction occurs between two compounds at 520° C. Graphs, table. 8 ref. (P16, M24, Fe, Te)

**9-P. (French.) Contribution to the Study of the Thermodynamic Proper-**

**ties of Copper-Platinum Alloys.** P. Assayag. *Annales de chimie (Paris)*, v. 10, July-Aug. 1955, p. 637-665.

Chemical equilibrium measurements used to study the thermodynamic properties of the alloys and their oxidation by oxygen. Graphs, tables. 27 ref. (P12, R2, Cu, Pt)

**10-P. (German.) Dielectric Properties of Iron Under Very Low Frequency and Under Influence of Front Area.** H. Gränicher, C. Jaccard, P. Scherrer and A. Steinemann. *Helvetica Physica Acta*, v. 28, no. 4, 1955, p. 300-303.

Gives data of the above with a suggestion to further investigation. Graphs. 4 ref. (P15, Fe)

**11-P. (German.) Manganese Interference Points in Gray Tin.** G. Busch and K. A. Müller. *Helvetica Physica Acta*, v. 28, no. 4, 1955, p. 319-320.

Data of experimental work in the range of 90 to 260° K. Graph. 7 ref. (P15, Mn, Sn)

**12-P. A Survey of Irradiation Effects in Metals.** J. W. Glen. *Advances in Physics*, v. 4, Oct. 1955, p. 381-478.

Effects on structure and on mechanical and physical properties; theory, correction of radiation damage by annealing. Graphs, tables. 196 ref. (P10, Q general, J23)

**13-P. Effect of Carbon on Interfacial Tension of Iron With Slag.** S. I. Popel, O. A. Esin and Yu. P. Nikitin. *Henry Brutcher Translation No.* 3116, 5 p. (From *Doklady akademii nauk SSSR*, v. 88, no. 2, 1952, p. 253-255.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 426-P, 1953. (P10, Fe)

**14-P. Determination of Surface Tension of Some Cast and Pig Irons.** K. Grütter and B. Marincek. *Henry Brutcher Translation No.* 3577, 7 p. (From *Schweizer archiv*, v. 19, no. 6, 1953, p. 171-173.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 426-P, 1953. (P10, Fe)

**15-P. Surface Tension of Liquid Iron-Carbon Alloys.** P. Kozakévich, S. Chatel and M. Sage. *Henry Brutcher Translation No.* 3578, 5 p. (Abridged from *Comptes rendus*, v. 236, May 27, 1953, p. 2064-2066.) Henry Brutcher, Altadena, Calif.

Measured at 1450° C. for alloys with 1 to 5% carbon, and at 1530° C. for alloys with less than 1% carbon. Results compared with published data. Graph. 3 ref. (P10, ST)

**16-P. (Russian.) New Phenomenological Theory of Superconductivity.** Iu. L. Klimontovich. *Doklady akademii nauk SSSR*, v. 104, no. 3, Sept. 21, 1955, p. 384-386.

Considers surface energy at boundary of the superconductive and normal phases of a metal. 2 ref. (P15)

**17-P. (Russian.) Effect of Sheet Thickness on the Magnetic Characteristics of Soft Magnetic Alloys.** E. I. Gurvich and E. Kondorskii. *Doklady akademii nauk SSSR*, v. 104, no. 4, Oct. 1, 1955, p. 530-532.

Decreasing sheet thickness of these alloys decreases magnetic penetrability and increases coercive force and hysteresis losses. Specimens of molybdenum permalloy and 50% permalloy, prepared in three ways, tested for this effect. Table, graph, micrographs. 5 ref. (P16, SG-p, Ni, Mo)

**18-P. (Russian.) Effect of the Form of Carbon on Magnetic Properties of Transformer Steel.** I. N. Bogachev, V. A. Koroleva and M. I. Sherstiuk. *Fizika metallov i metallovedenie*, v. 1, no. 1, 1955, p. 149-157.

Effect of distribution pattern of structurally free cementite, of cementite and graphite, aging of supersaturated alpha-solution on coercive force. Graphitization and normalization. Tables, micrographs, graphs. (P16, J24, N8, ST)

**19-P. (Russian.) Thermionic Emission Properties of Thin Thorium and Thorium Oxide Films on Metallic Foundations.** A. R. Shul'man and A. P. Rumiantsev. *Zhurnal tekhnicheskoi fiziki*, v. 25, no. 11, Oct. 1955, p. 1898-1909.

Results of measurements of films on platinum and molybdenum bases. Relation of thermionic emission current to time at oxidized cathodes during activation. Diagrams, tables, graphs. 7 ref. (P15, Th)

**20-P. Measurement of Total Emissivities of Gas-Turbine Combustor Materials.** S. M. De Corso and R. L. Coit. *ASME, Transactions*, v. 77, Nov. 1955, p. 1189-1196, disc., p. 1196-1197.

Data included showing emissivity of several metals and ceramic coatings as functions of temperature, surface treatment and previous history of the material. Diagram, graphs, table. 8 ref. (P17)

**21-P. The Fluctuating Field Model of Ferromagnetism With Particular Reference to Nickel.** F. D. Stacey. *Canadian Journal of Physics*, v. 33, Nov. 1955, p. 661-667.

Following Néel's calculations of fluctuations in intermolecular field, a model is suggested in which there is a mutual repulsion of elementary magnets, so that spontaneous magnetization, in the case of nickel, is affected by a process of ordering of the magnets on the lattice sites as well as in orientation. Table. 15 ref. (P16, Ni)

**22-P. High-Frequency Silicon-Aluminum Alloy Junction Diodes.** M. B. Prince. *Institute of Radio Engineers, Transactions on Electron Devices*, v. ED-2, Oct. 1955, p. 8-9.

Silicon-aluminum alloy junction diodes were made that have rectifying properties up to frequencies of 500 Mc. per sec. Recovery times from storage effects are of the order of 0.1 $\mu$ sec. Graph, diagrams. 6 ref. (P15, Al, Si)

**23-P. Grüneisen's Constant for Some Metals.** J. J. Gilvarry. *Journal of Chemical Physics*, v. 23, Oct. 1955, p. 1925-1927.

Redetermined from compressibility parameters for lithium, sodium and potassium to show good agreement with values from Grüneisen's law. Some anomalies for other metals are adjusted. Tables. 20 ref. (P10, EG-e)

**24-P. Activation Cross Sections of $Y_{90}$ and $Pr_{142}$.** R. R. Smith and S. D. Reeder. *Journal of Chemical Physics*, v. 23, Nov. 1955, p. 2108-2110.

The irradiation of $Y_{89}$ and $Pr_{141}$ under sufficiently high thermal neutron flux produces small amounts of $Y_{91}$ and $Pr_{142}$. Graphs. 13 ref. (P10, Y, Pr)

**25-P. The Melting Point of Germanium as a Function of Pressure to 180,000 Atmospheres.** H. Tracy Hall. *Journal of Physical Chemistry*, v. 59, Nov. 1955, p. 1144-1146.

Melting point decreases linearly from 936° C. at one atmosphere to 347° C. at 180,000 atmospheres. No new solid phases form in this region. Tables. (P12, Ge)

**26-P. The Low Temperature (11-20° K.) Specific Heat of Alpha and Beta Manganese.** G. L. Booth, F. E. Hoare and B. T. Murphy. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 830-832.

Specific heat of alpha Mn varies from 0.19 joule mole$^{-1}$ deg$^{-1}$ at 12° K. to 0.49 joule mole$^{-1}$ deg$^{-1}$ at 20° K.; the corresponding values for beta Mn are 0.62 joule mole$^{-1}$ deg$^{-1}$ and 1.18 joule mole$^{-1}$ deg$^{-1}$. Graphs. 8 ref. (P12, Mn)

**27-P. The Thermal Effects Associated With the Magnetization of High-Coercivity Materials.** L. F. Bates and A. W. Simpson. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 849-858.

Heat changes accompanying magnetization processes in materials of high coercivity over a field range of 4000 oersteds. Diagrams, graphs, tables. 8 ref. (P16)

**28-P. The Magnetic Susceptibility of Metallic Cerium.** L. F. Bates, S. J. Leach and R. G. Loasby. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 859-861.

Measurements at 90 to 1057° K. Graph. 12 ref. (P16, Ce)

**29-P. The Influence of Pressure on Metal-Germanium Contacts.** J. Lees and S. Walton. *Physical Society, Proceedings*, v. 68, no. 431B, Nov. 1, 1955, p. 922-928.

Dependence of the electrical properties of the germanium immediately below a point contact on the stress existing in this region investigated. Graphs, 9 ref. (P15, Q25, Ge)

**30-P. The Hall Effect in Metals at High Frequencies.** B. Donovan. *Physical Society, Proceedings*, v. 68, no. 431A, Nov. 1955, p. 1026-1032.

Theory of the Hall effect at high frequencies is developed in terms of the "surface Hall coefficient" defined in a similar manner to the complex surface impedance for metals. Calculations of this coefficient are carried through for a metal with two overlapping energy bands, and the variations with frequency and with field strength shown graphically for certain special cases. Graphs. 8 ref. (P15)

**31-P. Calculation of Magnetostriction Constants for Nickel.** G. C. Fletcher. *Physical Society, Proceedings*, v. 68, no. 431A, Nov. 1955, p. 1066-1071.

Calculations based on the collective electron model. 6 ref. (P16, Ni)

**32-P. The Surface Resistance of Normal and Superconducting Tin at 36 kMc/s.** E. Fawcett. *Royal Society, Proceedings*, v. 232, ser. A, Nov. 22, 1955, p. 519-537 + 1 plate.

A new calorimetric method developed to measure the surface resistance of plane single crystals of tin. Diagram, tables, graphs. 23 ref. (P15, Sn)

**33-P. Physical Metallurgy of Zirconium and Its Alloys.** A. R. Kaufmann and T. T. Magel. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 348-431.

Thermal, electrical and elastic properties, crystal structure and transformations, diffusion, deformation texture. Photographs, micrographs, tables, diagrams, graphs. 138 ref.
(P11, P15, Q21, M26, N general, Zr)

## Q

## Mechanical Properties and Test Methods; Deformation

**1-Q. Fatigue Tests and Aircraft Life Evaluation.** Tibor Haas. *Aircraft Engineering*, v. 27, Oct. 1955, p. 334-337.

Experimental correlation of service and fatigue tests at constant stress amplitude. Graphs, diagrams. 21 ref. (Q7, T24)

**2-Q. Determination of Strains in Enameled Cast Iron.** J. F. Wuellner and B. J. Sweo. *American Ceramic Society, Journal,* v. 38, Nov. 1955, p. 404-407.

Describes method using modification of split-ring furnace and cantilever-type specimens. Photograph, diagram, graphs. 3 ref. (Q25, L27, CI)

**3-Q. Stress and Strain in Rolling Mill Housings. II.** J. D. Keller. *Blast Furnace and Steel Plant,* v. 43, Nov. 1955, p. 1250-1258.

Discusses housings for cold reducing, hot strip, blooming mills and special housings. Photographs, diagrams. 1 ref. (Q25, F23)

**4-Q. Cast Steels. II.** J. Lomas. *Canadian Mining Journal,* v. 76, Oct. 1955, p. 80-82.

Mechanical properties and practical applications of austenitic steels. (To be continued.) (Q general, T general, CI)

**5-Q. Crack Formation and Stress Concentration Effects in Direct Stress Fatigue. II.** N. E. Frost. *Engineer,* v. 200, Oct. 7, 1955, p. 501-503.

Reversed direct stress (zero mean load) fatigue tests were carried out on vee-notched cylindrical specimens of aluminum alloy. Microscopic examination revealed that nonpropagating cracks could be formed in the root of the notch. Graphs, tables. 5 ref. (Q7, Al)

**6-Q. On the Theory of the Elasticity of Crystals.** C. V. Raman and K. S. Viswanathan. *Indian Academy of Sciences, Proceedings,* v. 42, sec. A, Aug. 1955, p. 51-70.

Shows that tensor representation of elastic strains and stresses should be in unsymmetrical form. Tables. 13 ref. (Q21)

**7-Q. The Creep of Metals.** N. P. Allen. *Times Science Review,* 1955, Winter, p. 17-18.

Explains some testing procedures and other factors to consider in choosing material to be used at various higher temperatures. Graphs, photograph. (Q3)

**8-Q. Handling Spring-Back in High Carbon Steel.** J. P. Malloy. *Tooling and Production,* v. 21, Nov. 1955, p. 89-91.

Explains control exercised through choice of material, tooling design and manufacturing method, process finishing or heat treatment. Photographs. (Q21, G general, CN)

**9-Q. Experiments on Brittle Fracture of Steel Plates.** D. K. Felbeck and E. Orowan. *Welding Journal,* v. 34, Nov. 1955, p. 570S-575S.

High velocity dependence of yield stress found to be decisive factor. Photographs, tables, graphs, diagrams. 16 ref. (Q26, Q23, CN)

**10-Q. Inhomogeneous Deformation in Rolling and Wire-Drawing.** B. B. Hundy and A. R. E. Singer. *Wire Industry,* v. 22, Oct. 1955, p. 969-971, 973, 996.

Considers advantages and deleterious effects on properties. Diagrams, tables. 25 ref. (Q24, F23, F28)

**11-Q.** (English.) **A Method for the Measurement of Elastic Relaxation, and Its Use for Determination of the Solubility of Carbon in Alpha-Iron.** E. Lindstrand. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 431-435.

Spiral samples twisted through certain angle and released tested photographically for creep. Photographs, diagram, tables. 11 ref. (Q21, Q3, N12, Fe)

**12-Q.** (English.) **Some Observations on the Internal Friction of Polycrystalline Aluminium During the Early Stages of Creep.** G. B. Brook and A. H. Sully. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 460-469.

Measurements at strain amplitudes less than $10^{-5}$ made at constant load of super and commercial-purity aluminum wires at room temperature, 250 and 350° C. Diagram, graphs, micrographs. 16 ref. (Q22, Q3, Al)

**13-Q.** (English.) **Activation Energies for Creep of Cadmium, Indium, and Tin.** R. E. Frenkel, O. D. Sherby and J. E. Dorn. *Acta Metallurgica,* v. 3, no. 5, Sept. 1955, p. 470-472.

Total plastic strain for high-temperature creep under constant load. Tables, graphs. 14 ref. (Q3, Sn, In, Cd)

**14-Q.** (Czech.) **Formation of Hydrogen Peroxide on Mechanically Stressed Metals in Aqueous Medium.** Vladimir Seifert, Karel Smrcek, Jan Vorlicek and Ivan Sekerka. *Hutnické listy,* v. 10, no. 10, Oct. 1955, p. 595-600.

During mechanical stressing of metals in an aqueous medium, hydrogen peroxide is formed because of ultrasonic waves which appear during the deterioration of the metallic microstructure. Facts proven by polarographic determination and photographic records of the stressed material. Diagrams, photographs, tables. 9 ref. (Q25, M27)

**15-Q.** (French and German.) **Hardness Determination.** W. Brandt. *Pro-Metal,* v. 7, no. 46, Aug. 1955, p. 528-540.

Describes and compares various methods of hardness determination with special emphasis on microhardness method and possibility of its standardization. Tables, diagrams, graphs, micrographs. 7 ref. (Q29)

**16-Q.** (German.) **The Development of Materials Showing High Strength at Elevated Temperatures.** Karl Bungardt. *Stahl und Eisen,* v. 75, no. 21, Oct. 20, 1955, p. 1383-1389.

Discusses austenitic chromium-nickel steels, chromium-cobalt-nickel-iron alloys and nickel and cobalt alloys; possibilities of further developments. Graphs, tables. 9 ref. (Q23, SG-h, Co, Ni, SS)

**17-Q.** (German.) **Surface Phenomena of an Extended Aluminum Monocrystal Relating to the Extension Speed.** H. Müller and G. Leibfried. *Zeitschrift für Physik,* v. 142, no. 2, 1955, p. 87-115.

Data of theoretical and model investigation on the subject. Graphs, diagrams, photographs, tables. 21 ref. (Q27, Al)

**18-Q.** (Japanese.) **Study on Fatigue Life of Metals by Means of Progressive Stress Fatigue Testing.** Nobuske Enomoto. *Journal of Railway Engineering Research (Japan),* v. 12, no. 15, Aug. 10, 1955, p. 363-370.

Compares results of this Prot method with those of conventional procedure. Tables, graphs, diagrams. 10 ref. (Q7)

**19-Q.** (Polish.) **Plastic Deformation of Steel at the Tensile and Hardness Test.** Wojciech Truszkowski. *Archiwum gornictwa i hutnictwa,* v. 3, no. 3, 1955, p. 345-377 + 1 plate.

A greater load is required to initiate plastic deformation in alloys that show a sharp yield point in the tensile test. At the upper yield point, stress decreases rapidly and further elongation occurs at a nearly constant value of stress. Tables, micrographs, graphs. 32 ref. (Q24, Q27, Q29, ST)

**20-Q.** (Russian.) **Fracture of Metals at High Temperatures.** I. Ia. Dekhtiar and K. A. Osipov. *Doklady Akademii nauk SSSR,* v. 104, no. 2, Sept. 11, 1955, p. 229-232.

Appearance of internal defects in stages preceding fracture; effect of load action and temperature on the development of defects with time. Relates life of material to temperature and load. Graph. 12 ref. (Q26)

**21-Q.** (Russian.) **Nature of Fracture of Metals During Creep.** V. S. Ivanova. *Metallovedenie i obrabotka metallov,* 1955, no. 1, July, p. 19-26.

Theories suggested include that of the intensity of vacancy formation during creep. Discusses relation between stress and time up to fracture in steels with low creep resistance and of the deformation resistance and cohesive strength to service life of a metal. Graphs, diagrams. 17 ref. (Q26, Q3, ST)

**22-Q.** (Russian.) **Effect of Initial Heat Treatment on the Brittle Strength of the Nitrided Layer of Steel 38KhMIuA.** N. A. Fertik. *Metallovedenie i obrabotka metallov,* 1955, no. 1, July, p. 57-61.

Isothermal transformations, microstructure, high-frequency induction heating for improving structure. Table, graphs, diagram, micrographs. 2 ref. (Q23, J general, M27, AY)

**23-Q.** (Russian.) **Effect of Tempered Chromium-Plated Parts on Their Wear Resistance and Sticking in Operation.** D. N. Garkunov and F. N. Naumov. *Vestnik mashinostroeniia,* v. 35, no. 10, Oct. 1955, p. 34-37.

Effect of tempering temperature and smoothness of chromium coatings on wear. Graphs, diagrams, tables. (Q9, L17, Cr, ST)

**24-Q. Elevated Temperature Strength of Selected Zirconium-Base Alloys.** R. J. Van Thyne and D. J. McPherson. *American Society for Metals, Transactions,* v. 48, *Preprint No.* 46, 1955, 14 p.

Of the alloys with high strength properties at 650 and 800° C., those with aluminum and tin were superior. Zirconium-tantalum phase relationships appear to be the eutectoid type. Tables. 9 ref. (Q23, M24, Zr)

**25-Q. Photo-Elastic Investigation of Armoured Models With an Application to Bending Bars With Cracks on the Tensile Side.** R. G. Boiten. *Applied Scientific Research,* v. 5, sec. A, no. 5, 1955, p. 359-373.

Influence of cracks which often occur at the tensile side of reinforced concrete bars. Graphs, photographs, diagrams, tables. (Q27)

**26-Q. Research Report on Brittleness of Metals.** J. E. McLennan, S. T. M. Johnstone and H. L. Wain. *Australasian Engineer,* 1955, Sept., p. 67-75.

Results of recent work on the brittleness of ferrous alloys, molybdenum and chromium. Photographs, graphs, tables. 43 ref. (Q23, Fe, Mo, Cr)

**27-Q. The Collapse Behaviour of Vierendeel Trusses.** S. Henderson. *Engineering,* v. 180, Nov. 4, 1955, p. 632-636.

Behavior of several model trusses, compared with simple plastic theory. Photographs, diagrams, graphs. 5 ref. (Q24)

**28-Q. Residual Lattice Strains in Sectioned Bars of Plastically Deformed Iron.** C. J. Newton and H. C. Vacher. *Journal of Metals,* v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 203, Nov. 1955, p. 1193-1194.

Two test rods were of ingot iron annealed at 910° C.; after deformation they were polished, etched and X-rayed for several readings. Tables. 10 ref. (Q24, M26, Fe-p)

**29-Q. Photoelastic Determination of Bending Moments in Curved Frames.** V. Cadambe and R. K. Kaul. *Journal of Scientific & Industrial Research*, v. 14, sec. B, Oct. 1955, p. 485-488.

Shows that bending moments can be easily determined from the photoelastic fringe pattern, without recourse to strain energy methods. Application of the theory is illustrated in the case of a thick circular ring under diametral tension. Diagrams, table. 1 ref. (Q25)

**30-Q. How to Avoid Brittle Failures in Steel.** G. H. Enzian. *Materials & Methods*, v. 42, Nov. 1955, p. 116-118.

Failures can be avoided by careful design, proper heat treatment and care in fabrication. Photographs, graphs. (Q23, CN, AY)

**31-Q. Some Recent Experiments in Friction.** F. P. Bowden. *Nature*, v. 176, Nov. 19, 1955, p. 944-946.

Measuremens of friction and wear on copper and bismuth at sliding velocities up to 1000 m. per sec. Graph, diagram, micrographs. (Q9, Cu, Bi)

**32-Q. Investigation of Plasticity of Technical Titanium.** L. N. Sokolov, V. P. Elyutin and V. I. Zalesskii. *Henry Brutcher Translation No.* 3517, 7 p. (From *Izvestiya akademii nauk SSSR, OTN*, 1954, no. 3, p. 110-115.)

Previously abstracted from original. See item 246-Q, 1955. (Q23, Ti)

**33-Q. Influence of Cold Working and Aging Upon Strength and Toughness of Low-Carbon Basic Bessemer Steels Blown With Oxygen-Enriched Blast or With an Oxygen-Steam Mixture.** A. Krüger. *Henry Brutcher Translation No.* 3534, 29 p. (From *Stahl und Eisen*, v. 74, no. 27, 1954, p. 1757-1766.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 333-Q, 1955. (Q23, D3, CN)

**34-Q.** (Czech.) **Life of Aluminized and Alited Steels Under High Temperatures.** Pavel Gröbner. *Hutnické listy*, v. 10, no. 10, Oct. 1955 p. 600-605.

Prolongation of the life of aluminized steels at high temperatures can be obtained by certain alloys in the steel. Carbon retards diffusion of aluminum into the steel. Graphs. 12 ref. (Q general, L15, Al, ST)

**35-Q.** (Hungarian.) **Investigation of the Most Outstanding Mechanical Properties of Special Ductile Alpha + Beta Brasses, as Affected by Heat Treatment. III.** Ede Bella. *Kohaszati lapok*, v. 10, no. 10, Oct. 1955, p. 460-466.

Effects of heat treating NSIII brasses. Tables, graphs, micrographs. 25 ref. (Q23, J general, Cu)

**36-Q.** (Russian.) **Theory of Fracture of Metals Under Cyclical Loading.** I. A. Oding. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 4-8.

Results of fatigue testing in case of asymmetrical cycles of bending and torsion tests. Theory of crystal lattice vacancies used to explain mechanism of fatigue fracture and peculiarities of stress behavior of metals. Graphs. 11 ref. (Q26, Q7, ST, AY, Cu)

**37-Q.** (Russian.) **Tendency of Metals to Cold Shortness Under Conditions of Static Tension.** G. I. Pogodin-Alekseev. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 8-14.

Results of static tensile testing of duralumin, steel and brass from 100 to 196° C., including yield point and relative and average elongation: change of properties in reheated steel; relation of plasticity and brittleness to temperature. Tables, graphs. (Q23, Q27, Al, AY, Cu)

**38-Q.** (Russian.) **Improving Mechanical Properties of Bridge Steel.** L. F. Molotkov, V. M. Iuferov, G. E. Tsukanov, E. M. Chernevich, E. M. Bortunov and N. G. Sorochan. *Stal'*, v. 15, no. 10, Oct. 1955, p. 930-937.

Chemical composition of steels; effect of deoxidation method, rolling conditions, normalization and cooling rate after rolling on impact toughness; resulting microstructure and other mechanical properties. Tables, graphs, micrographs. 6 ref. (Q6, Q23, M27, CN)

**39-Q. Structure of Cross-Section of Wide-Strip Steel M16S.** V. A. Nikitskaia. *Stal'*, v. 15, no. 10, Oct. 1955, p. 937-941.

Defects of longitudinal cross sections may be caused, not by the properties of the metals, but by external conditions due to testing: testing time in dynamic bending test of deeply notched specimens is a factor. Effect of anisotropy of metal. Photographs, micrographs, tables. 5 ref. (Q5, Q general, ST)

**40-Q. The Effects of Carbon, Oxygen, and Nitrogen on the Mechanical Properties of Titanium and Titanium Alloys.** H. R. Ogden and R. I. Jaffee. *Battelle Memorial Institute, Titanium Metallurgical Laboratory Report No.* 20, Oct. 1955, 74 p.

Alpha solute interstitial elements strengthen titanium, although the effect is lost at elevated temperatures. They also have a deleterious effect on toughness, notch sensitivity, weld ductility, machinability and blend ductility. Graphs. 52 ref. (Q general, Ti)

**41-Q. Tensile-Creep Properties at 500° F. of Zirconium and a 3.66 Per Cent Uranium Alloy of Zirconium.** A. D. Schwope and G. T. Muehlenkamp. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-799, Nov. 1952, 12 p.

Zirconium is studied from 10,000 to 17,000 psi. and its uranium alloy from 20,000 to 30,000 psi. Tables, graphs. (Q3, U, Zr)

**42-Q. Investigation of Wrought Iron-Chromium-Aluminum Alloys for Service at 2200° F.** H. A. Saller, J. T. Stacy and N. S. Eddy. *Battelle Memorial Institute, (U. S. Atomic Energy Commission)*, BMI-922, June 1954, 46 p.

Effects of a number of added elements on the workability, oxidation resistance, strength, dimensional stability, bend ductility, hardness and microstructure of an iron-chromium aluminum alloy. Tables, graphs, diagram, micrographs. 17 ref. (Q general, Al, Cr, Fe)

**43-Q. Nickel-Free and Low Nickel Austenitic Stainless Steels.** D. J. Carney. *Blast Furnace and Steel Plant*, v. 43, Dec. 1955, p. 1377-1380.

Completely austenitic steel at 2300° F. can be produced with chromium contents above 17% with little or no nickel, and nitrogen content up to 0.50%. Structure and mechanical properties. Graphs, diagrams, table. 1 ref. (Q general, M27, SS)

**44-Q. Creep and Static Friction.** R. T. Spurr. *British Journal of Applied Physics*, v. 6, Nov. 1955, p. 402-403.

It is shown that the static friction between a soft metal hemisphere and a flat surface increases with the length of time the surfaces have been in contact and that this increase is due to creep. Such creep might account for the difference between static and dynamic coefficients of friction. Diagram, graphs. 2 ref. (Q9, Q3)

**45-Q. Cast Steels. III.** J. Lomas. *Canadian Mining Journal*, v. 76, Nov. 1955, p. 76-78.

Mechanical and physical properties. Tables. (Q general, P general, CI)

**46-Q. Triaxial Plastic Stress-Strain Relations for an Aluminum Alloy 14S-T4.** Joseph Marin and H. A. B. Wiseman. *Franklin Institute, Journal*, v. 260, Nov. 1955, p. 397-409.

It is concluded that the simple flow theory gives a good prediction of the stress-strain relations for various tri-axial stress tests using constant stress ratios, and that for the variable stress-ratio tests conducted, the simple flow theory is in poor agreement with test results. Diagrams, graphs. 5 ref. (Q27, Al)

**47-Q. Experiments on Aluminum Crystals Subjected to Slowly Alternating Stresses.** N. Thompson, C. K. Coogan and J. G. Rider. *Institute of Metals, Journal*, v. 84, Nov. 1955, p. 73-80.

Apparatus used to investigate effects of slowly alternating tension and compression on single crystals of pure aluminum. Discusses hysteresis loop, creep and interrelation between creep rate and rate of work hardening. Diagrams, graphs, table. 13 ref. (Q25, Q3, Al)

**48-Q. The Theory of Plasticity: A Survey of Recent Achievements.** William Prager. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 21, 1955, p. 41-57.

Applications in mechanical engineering. Diagrams, graphs, photographs. 94 ref. (Q23)

**49-Q. Some Experiments Into the Behaviour of Plain and Notched Steel Specimens Under Static and Fatigue Loadings.** J. W. Fitchie. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 18, 1955, p. 331-344.

Results may be useful in indicating influence of variables. Diagrams, graphs, tables. 13 ref. (Q27, Q7, ST)

**50-Q. The Effect of Torsional Overstrain Upon the Static Strength of Spring Steel.** J. A. Pope and J. E. Andrew. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 19, 1955, p. 345-360.

Effect of low-temperature heat treatment on the static properties of a hardened and tempered spring steel which had been previously subjected to torsional overstrain. Diagrams, graphs, tables. 11 ref. (Q27, Q1, ST)

**51-Q. Deformation of an Explosively Loaded Aluminum Single Crystal.** John S. Rinehart. *Journal of Applied Physics*, v. 26, Nov. 1955, p. 1315-1317.

Deformation pattern as it relates to the stresses set up by the explosive and the crystallographic axes of the crystal. Diagrams. 9 ref. (Q24, M26, Al)

**52-Q. Deformation and Recrystallization Textures of Rolled Uranium Sheet.** Melvin H. Mueller, Harold W. Knott, and Paul A. Beck. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1214-1218.

Rolling and recrystallization textures in 300° C. rolled uranium sheet investigated using a Geiger counter diffractometer with the modified Schulz reflection technique. Diagrams, tables. 8 ref. (Q24, N5, U)

**53-Q. Creep of Polycrystalline Tin.** J. E. Breen and J. Weertman. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers. Transactions*, v. 203, Nov. 1955, p. 1230-1234.

Creep rate studied as a function of temperature and stress in constant stress experiments. Temperature was varied from room temperature to almost the melting point of tin. Graphs. 16 ref. (Q3, Sn)

**54-Q. Cleavage Steps on Zinc Monocrystals: Their Origins and Patterns.** John J. Gilman. *Journal of Metals*, v. 7; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 203, Nov. 1955, p. 1252-1255.

Characteristic cleavage step patterns observed on cleavage surfaces of undeformed, slipped, bent, twinned, compressed and indented zinc crystals. Effect of temperature. Photographs, diagram. 10 ref. (Q24, Zn)

**55-Q. Residual Stresses.** E. S. Nachtman. *Machine Design*, v. 27, Dec. 1955, p. 211-214.

Effects of residual stresses in cold drawn bars on subsequent fabrication procedures. Graphs. (Q25, F27, CN)

**56-Q. The Effects of Alloying Additions on the Properties of Carbon Steels.** A. G. Gardner. *Machinery (London)*, v. 87, Nov. 11, 1955, p. 1143-1146.

Effects of nickel, chromium, tungsten, molybdenum, vanadium, cobalt, aluminum, manganese, phosphorus, silicon or sulphur on mechanical and physical properties. (Q general, P general, AY)

**57-Q. Effect of Temperature on the Flow Stress of Work-Hardened Copper Crystals.** M. A. Adams and A. H. Cottrell. *Philosophical Magazine*, v. 46, 7th ser., no. 382, Nov. 1955, p. 1187-1193.

Changes in the flow stress of copper crystals due to changes in the temperature of deformation have been measured. The change of flow stress with temperature is closely proportional to the flow stress itself. Graphs, tables. 15 ref. (Q24, Cu)

**58-Q. The Formation of Cracks in Plastic Flow. II.** A. N. Stroh. *Royal Society, Proceedings*, v. 232, ser. A, Nov. 22, 1955, p. 548-560.

Detailed mechanism by which a piled-up group of dislocations generates a crack. It is suggested that a crack arises from short-range non-Hookian interactions of the dislocations at the head of the pile-up, and a model which takes some account of this is developed. Diagrams, graph. 15 ref. (Q26, M26)

**59-Q. War on Wear.** Van Caldwell. *Steel*, v. 137, Nov. 28, 1955, p. 98-101.

Causes of wear, preventive measures, alloys for impact and abrasion resistance, surface treatment processes. Tables. (Q9, L general)

**60-Q. Friction in the Processing of Metals.** Antoni Niedzwiedzki. *Tooling and Production*, v. 21, Dec. 1955, p. 98-102.

Shows to what extent chip formation and other metal processing phenomenon can be explained in terms of friction. Graphs, tables, diagrams. 29 ref. (Q9, G17)

**61-Q. Mechanical Properties of Zirconium and Its Alloys.** W. Chubb, G. T. Muehlenkamp, F. R. Shober and A. D. Schwope. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 490-552.

Tensile, impact, creep and hardness characteristics. Effects of composition, structure, heat treatment and deformation on these properties. Tables, graphs, photographs, micrographs. 70 ref. (Q general, Zr)

**62-Q. A Method for Estimating Allowable Load Capacities of Columns Subject to Creep.** R. L. Carlson and A. D. Schwope. Paper from "Proceedings of the Second U.S. National Congress of Applied Mechanics." 1954. The American Society of Mechanical Engineers, p. 563-568.

Method utilizes approximate stress distributions derived from iso-stress-strain curves to determine column loads which are shown to be conservative for the time for which a determination is made. Graphs. 10 ref. (Q3)

**63-Q. Industrial Applications of X-ray Stress Analysis.** A. Schaal. *Henry Brutcner Translation No.* 3089, 9 p. (Abridged from *Archiv Eisenhüttenwesen*, v. 26, no. 8, 1955, p. 445-447.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 906-Q, 1955. (Q25, M22)

**64-Q.** (Russian.) **Influence of Hydrogen on Mechanical Properties of Electrolytic Nickel.** A. L. Rotinian, E. Sn. Ioffe, E. S. Kozich and I. I. Iusova. *Doklady akademii nauk SSSR*, v. 104, no. 5 Oct. 11, 1955, p. 753-755.

Effect of hydrogen and hydrides adsorbed from electrolyte by surface of growing deposit. Graphs. 17 ref. (Q general, C23, Ni)

**65-Q.** (Russian.) **Study of Texture of Cold Rolling and Recrystallization in Iron and its Alloys With Silicon.** K. V. Grigorov, G. P. Blokhin, E. A. Korzun and M. I. Zakutner. *Fizika metallov i metallovedenie*, v. 1, no. 1, 1955, p. 36-47.

Texture of deformation and of primary recrystallization; effect of annealing during cold rolling of recrystallization texture and of grain coarsening on texture of primary recrystallization. Graphs, diagrams. 8 ref. (Q24, N5, J23, ST, Fe)

**66-Q.** (Russian.) **Effect of Columbium and Titanium on the Properties of Stainless Steel.** A. M. Samarin and A. A. Iaskevich. *Izvestiia akademii nauk SSSR, otdelenie tecknicheskikh nauk*, 1955, no. 10, Oct., p. 107-116 + 2 plates.

Chemical composition, mechanical properties of castings of these steels with various heat treatments, resistance to intercrystalline and chemical corrosion; weldability. Tables, micrographs, graphs. (Q23, R2, R6, K9, SS, Cb, Ti)

**67-Q.** (Russian.) **Study of Microhardness of Solid Solutions in Relation to Composition.** V. M. Glazov, G. A. Korol'kov and I. D. Chistiakov. *Izvestiia akademii nauk SSSR, otdelenie tekhnicheskikh nauk*, 1955, no. 10, Oct., p. 143-146.

Microhardness-composition relations for aluminum alloys with tantalum, lead or copper. The last alloy was quenched from different temperatures. Graphs, table. 6 ref. (Q29, Al)

# R
## Corrosion

**1-R. Initial Studies on the Effect of High Level Gamma Radiation on Corrosion of Metals.** F. Hittman and O. A. Kuhl. *Brookhaven National Laboratory (U. S. Atomic Energy Commission)*, BNL-2257, July 1955, 24 p.

Considers various structural materials in corrosive chemical systems from room temperature to 500° C. Diagrams, graph, photographs, micrographs. 10 ref. (R11)

**2-R. Control of Couples Developed in Water Systems.** G. B. Hatch. *Corrosion*, v. 11, Nov. 1955, p. 461-468.

Solution of copper by water on passage through cuprous portions of the system and its subsequent deposition on the ferrous metal portions is prevented by 2-benzothiazolethiol which inhibits water attack on the copper. Table, graphs. 8 ref. (R10, Fe, Cu)

**3-R. Corrosion of Lead-Lined Sulfuric Acid Evaporators.** W. J. Cotton. *Corrosion*, v. 11, Nov. 1955, p. 469-470.

Two cases involving failure by corrosion of lead linings in evaporators reported to determine causes of failure. (R6, Pb)

**4-R. Corrosion Control on Offshore Drilling and Producing Equipment.** Charles J. Fritts. *Corrosion*, v. 11, Nov. 1955, p. 471-476.

Steel piling is preferred for offshore stationary drilling platforms. Specific recommendations for corrosion control are made for the three areas into which the platform is divided. Photographs, graphs. (R general)

**5-R. The Electrochemical Behavior, Including Hydrogen Overvoltage, of Iron in Acid Environments.** Milton Stern. *Electrochemical Society, Journal*, v. 102, Nov. 1955, p. 609-616.

Corrosion rate of pure iron in deaerated acid media studied as a function of pH and related to electrochemical behavior. Graphs, diagram. 21 ref. (R5, R11, Fe)

**6-R. A Further Study of the Oxidation of Titanium and Its Alloys at High Temperatures.** A. E. Jenkins. *Institute of Metals, Journal*, v. 23, Sept. 1955, p. 1-9.

Investigations were completed in the temperature range 650 to 950° C. and at oxygen pressures ranging from 700 to 40 mm. of mercury. The initial period in the oxidation of the pure metal conforms to a parabolic law, which is valid until the formation of an initial coherent scale layer on the specimen to what appears to be a constant thickness. Diagrams, graphs, tables. 5 ref. (R2, Ti)

**7-R. Effect of Heat Treatment on the Corrosion Behavior of Zirconium Binary Alloys of Nickel and Iron.** D. S. Kneppel. *Nuclear Metals, Inc. (U. S. Atomic Energy Commission)*, NMI-1137, June 1955, 42 p.

Behavior in 680° F. water depends on condition of transformation stress in metal, presence of second phase zirconium compound of iron and nickel and amount of iron or nickel in solution in alpha zirconium. Tables, micrographs. 9 ref. (R4, J2, Zr)

**8-R.** (French.) **The Precipitation of $Fe_3O_4$ in Scales Formed by Oxidation of Iron at Elevated Temperatures.** J. Paidassi. *Acta Metallurgica*, v. 3, no. 5, Sept. 1955, p. 447-451.

Precipitation, observed in the FeO layer, forms only during their cooling down by decomposition of the monoxide; prevention of this decomposition is more difficult if the oxidation or re-oxidation temperature is above 980° C.; the oxygen concentration in FeO rich in oxygen is the predominating factor in their instability during rapid cooling. Micrographs. 5 ref. (R2, Fe)

**9-R.** (German.) **Influence of Steam Admixtures on the Durability of Turbine Blades.** M. Werner. *Brennstoff-Wärme-Kraft*, v. 7, no. 10, Oct. 1955, p. 433-439.

Investigates action of pH number on blade deterioration; evaluates Splittgerber and Pohl's hypothesis of sulfide action on nickel steel turbine blades. Photographs, micrographs, graphs, tables, diagram. 5 ref. (R4, ST, Ni)

**10-R.** (German.) **Condenser and Preheater Corrosion.** W. Katz. *Brennstoff-Wärme-Kraft*, v. 7, no. 10, Oct. 1955, p. 439-445.

Corrosion phenomena on copper occurring in connected condensers and preheaters; material and its

selection; suggestions for preventive measures. Graphs, photographs, table. 7 ref. (R4, Cu)

**11-R. (German.) Contribution to Scaling of Rolled Materials by Flames.** H. Wiegand, K. Schaar and F. Nieth. *Metalloberfläche*, Ausgabe A, v. 9, no. 10, Oct. 1955, p. 162-173.

Studies of scaling of different rolled materials caused by acetylene flames. Diagram, graphs, micrographs, tables. 13 ref. (To be continued.) (R2)

**12-R. (Italian.) Problem of the Protection of Methane Pipes Against Electrolytic Corrosion. I. Electrolytic Corrosion: Causes, Characteristics, and Methods of Protection. II. Cathodic Protection.** G. Bianchi. *Rivesta dei combustibili*, v. 9, nos. 8-9, Aug.-Sept. 1955, p. 675-711.

Thermodynamic and kinetics aspects, passive and active protection, electrical and electrochemical cathodic protection. Diagrams, graphs. 6 ref. (To be continued.) (R1, R10, R8)

**13-R. (Polish.) The Chemical Action of Chlorine and Its Compounds on Metals and Metallic Oxides.** Władysław Domanski. *Archiwum gornictwa i hutnictwa*, v. 3, no. 3, 1955, p. 401-435.

Method of calculating chemical affinity of metals for chlorine gas as a function of temperature illustrated in its application to the analysis of the Betterton process. Results confirmed by the data of metallurgical practice. Graphs, tables. 11 ref. (R9)

**14-R. Stress-Corrosion Cracking of Welded Joints.** R. N. Parkins. *British Welding Journal*, v. 2, Nov. 1955, p. 495-501.

Stress-corrosion cracks in welded joints are usually due to residual tension stresses in the joints, but may arise from the development of a critical metallographic structure in the heat-affected zone. Graph, micrograph, photographs, tables. 26 ref. (R1, K9)

**15-R. Reduction of Iron and Copper Corrosion in Steam and Water Cycle With Amines.** S. M. Sperry. *Combustion*, v. 27, Nov. 1955, p. 65-71.

Treatment of boiler feedwater for elimination of corrosion. Tables, graphs. 6 ref. (R10, R4, Fe, Cu)

**16-R. Electrode Potentials. I.** G. W. Akimov. *Corrosion*, v. 11, Nov. 1955, p. 477-486. (Translated from the Russian by R. B. Mears and J. D. Gat.)

Electrode potentials of a metallic surface immersed in an electrolyte are important in considering corrosion behavior. Reversible and irreversible electrode potentials, theory of electrode potentials, irreversible potentials of electrodes, factors affecting electrode potentials studied. Diagrams, graphs, tables. (To be continued.) (R11)

**17-R. Use of Ammonia to Prevent Casing Corrosion.** H. E. Greenwell, Rado Loncaric, and Harry G. Byars. *Corrosion*, v. 11, Nov. 1955, p. 491-496.

Laboratory experiments and special injection equipment solve problems in use of ammonia to stifle casing corrosion. Graphs, photographs, tables. 8 ref. (R10)

**18-R. Electrochemical Studies of the Hydrogen Sulfide Corrosion Mechanism.** Scott P. Ewing. *Corrosion*, v. 11, Nov. 1955, p. 497-501.

Anodic and cathodic reactions are given, and the corrosion process explained in terms of electrochemical properties of the corroding solution and corrosion products. Graphs. 8 ref. (R1)

**19-R. Atmospheric Corrosion of Aluminium Alloys in a Large Chemical Factory and Their Protection by Painting.** W. D. Clark. *Institute of Metals, Journal*, v. 84, Oct. 1955, p. 33-41 + 3 plates.

A total of 1100 specimens of five aluminum alloys in different conditions of heat treatment and a few mild steel specimens were exposed for 4 years and observations made on their rate of deterioration. Relative merits of 18 paint systems used on the aluminum alloys. Tables, micrographs, photographs. 3 ref. (R3, L26, Al)

**20-R. Attack of Metals by Sulfur and Gaseous Sulfur Compounds.** O. Kubaschewski and O. von Goldbeck. *Henry Brutcher Translation No.* 3115, 16 p. (From *Metalloberfläche*, v. 8, no. 3, 1954, p. A33-A36.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 192-R, 1954. (R2, R9)

**21-R. Behavior of Titanium in Gases at High Temperatures.** P. Spinedi. *Henry Brutcher Translation No.* 3585, 10 p. (From *Aluminio*, v. 23, 1954, p. 35-39.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 231-R, 1954. (R2, Ti)

**22-R. (Hungarian.) The Effect of Varying the Experimental Factors Upon the Results of the Mylius Corrosion Test.** Gabor Szönyi. *Kohäszati lapok*, v. 10, no. 10, Oct. 1955, p. 444-451.

Investigations for determining sources of error, limits of accuracy and recommended applications. Graphs, tables, micrographs, photographs, diagram. 13 ref. (R11)

**23-R. (Hungarian.) Corrosion Damage in the Hungarian Chemical Industry.** Klara Kovacs. *Magyar kémikusok lapja*, v. 10, no. 10, Oct. 1955, p. 306-309.

Evaluation of the data collected for 1953 by the Corrosion Observation Service; damages and costs, methods of combatting damage. Tables. 5 ref. (R general)

**24-R. A Study of the Reaction of Metals and Water.** H. M. Higgins. *Aerojet-General Corporation (U. S. Atomic Energy Commission)*, AECD-3664, Apr. 1955, 59 p.

Reactions of molten zirconium, Zircaloy-2, uranium, uranium-molybdenum alloy, aluminum, aluminum-lithium alloy and magnesium with water. Corrosion rate tests of zirconium, uranium-molybdenum alloy, and stainless steel in water at atmospheric pressure and at 600 psi. Photographs, graphs, diagrams, tables. 12 ref. (R4, R11, Zr, U, Mo, Al, Li, Mg)

**25-R. The Cathodic Protection of Ships Against Sea-Water Corrosion.** *American Society for Naval Engineers, Journal*, v. 67, Nov. 1955, p. 1074-1087.

Application of cathodic protection to the under-water surface of ships' hulls. Graph, diagrams. (R10)

**26-R. Exposure Tests on Three Types of Pipe.** M. J. Shelton and Bert C. Wilkas. *American Water Works Association, Journal*, v. 47, Nov. 1955, p. 1107-1123.

Soil corrosion tests of asphalt-mastic-coated steel, cast iron and asbestos-cement pipes. Diagrams, photographs, tables, graph. 2 ref. (R8, Cl)

**27-R. In-Service Corrosion Testing.** *Chemical and Engineering News*, v. 33, Nov. 28, 1955, p. 5152-5154.

Changes in electrical resistance with decreasing cross section can be directly related to corrosion. (R11)

**28-R. A Note on the Value of Ammonia Treatment for Tank and Casing Annulus Corrosion by Hydrogen Sulfide.** Walter F. Rogers. *Corrosion*, v. 11, Nov. 1955, p. 488-490.

Ammonia appears to have little beneficial effect when injected into tank in which steel has been exposed to sulfide vapors. Analogous results predicted from injection of ammonia into the casing-tubing annular space of sulfide producing wells. Graph, tables. 3 ref. (R10)

**29-R. The Corrosion Behavior of Aluminum.** Hugh P. Godard. *Corrosion*, v. 11, Dec. 1955, p. 542-552.

Practical corrosion behavior of aluminum. Diagram, tables, graphs. 29 ref. (R general, Al)

**30-R. Corrosion in the Motor-Car. IV. Bearings and Exhaust Valves.** Z. S. Michalewicz. *Corrosion Technology*, v. 2, Nov. 1955, p. 334-338.

Causes and corrosion properties of the main types of bearing metals. High temperature resistant valve steels safeguard against valve corrosion. Graphs, micrographs, photographs, table. 17 ref. (R2, R9, Pb, Cd, Cu, Ag, Al, ST)

**31-R. Corrosion Inhibitors in Petroleum Refinery Service.** *Corrosion Technology*, v. 2, Nov. 1955, p. 343-347.

General review emphasizing proper applications. Photographs. 10 ref. (R10)

**32-R. Corrosion Research Laboratories. VI. Cebelcor—The Belgian Corrosion Research Centre.** Alex Pirson. *Corrosion Technology*, v. 2, Nov. 1955, p. 348-354.

Description of the organization and workings of a Belgian corrosion research laboratory. Diagrams. 40 ref. (R general, A9)

**33-R. Cathodic Protection Cuts Repairs.** J. B. Prime. *Electrical World*, v. 144, Dec. 12, 1955, p. 104-106.

Successful application to structures and equipment in generating plants that use salt water for condensing. Diagrams, photographs. (R10)

**34-R. The Effect of Alloying Elements in Iron on Hydrogen Overvoltage and Corrosion Rate in Acid Environments.** Milton Stern. *Electrochemical Society, Journal*, v. 102, Dec. 1955, p. 663-668.

Sulfur, phosphorus and carbon proved detrimental to corrosion resistance. Tables, graphs. 9 ref. (R5, Fe)

**35-R. Filiform Corrosion.** A. Bukowiecki. *Engineers' Digest*, v. 16, Nov. 1955, p. 531-532. (Translated from *Schweizer Archiv*, v. 21, no. 5, May 1955, p. 165-168.)

Previously abstracted from original. See item 278-R, 1955. (R2)

**36-R. Corrosion.** Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 47, Nov. 1955, p. 81A-82A, 84A.

Concentration cell corrosion, its cause and practical evaluation procedures. Photographs, diagram. 1 ref. (R1, R11)

**37-R. Studying Corrosion Rates.** W. R. Pollard and J. V. Lawson. *Industrial and Engineering Chemistry*, v. 47, Nov. 1955, p. 2282-2283.

A model pilot plant is used for studying corrosion from Chlorex, which is used to separate lubricating stocks into paraffinic and naphthenic fractions. Corrosion coupons used to evaluate alcohols, organic phosphates, mercaptans and amines as inhibitors. Diagram, table, graph. (R11)

**38-R. Observations on the Internal Corrosion of Tin-Plate Cans by Acid Foodstuffs.** H. Cheftel, J. Monvoisin and Malwina Swirski. *Journal of the Science of Food and Agriculture*, v. 6, Nov. 1955, p. 652-655.

It is shown that the anodic behavior of tin versus iron in the corrosion of tin plate by canned foods is what would be expected on theoretical grounds. With reference to

the fact that the hydrogen evolved during the corrosion of tin plate is less than the amount corresponding to the metals dissolved, an electrochemical mechanism is suggested which may account in part for this deficit. Attention is also drawn to previously unsuspected accelerators of corrosion (e.g., caramelization products in fruits.) Tables. 12 ref. (R5, Sn)

**39-R. Design Features Affecting Digester Corrosion.** L. G. Pfeiffer, M. A. Scheil and E. H. Schmidt. *Tappi*, v. 38, Nov. 1955, p. 652-659.

Circulation systems, supports, internal projections and protection of walls by baffling, surface preparation, stress relief and radiography, field repair. Diagrams, micrographs, photographs. (R7, ST)

**40-R. Corrosion of Zirconium and Its Alloys.** B. Lustman, editor. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 553-686.

Theory, behavior and mechanisms in gases, water, chemical solutions and liquid metals. Electrode reactions. Tables, graphs, photograph, micrographs, diagrams. 200 ref. (R general, Zr)

**41-R. (French.) The Dry Oxidation of Iron and Steel.** Lucia de Brouckere and Madeleine Mathys-Solvel. *Industrie Chimique Belge*, v. 20, no. 1, Jan. 1955, p. 35-53.

Studies of iron and of a mild steel exposed to pure air between 200 and 900° C. Micrographs, graphs, tables. 10 ref. (R2, Fe, CN)

**42-R. (German.) Corrosion Bibliography.** *Werkstoffe und Korrosion*, v. 6, 1955 Supplement, p. 618-716.

Gives 775 abstracts in the following classifications: general, theory, measurement; ferrous and nonferrous metals, organic materials, metallic and organic coatings. (R general)

**43-R. (Swedish.) The Effect of the Annealed Layer on Contact Corrosion in Welded Finished Steel.** Tore Norén. *Svetsaren*, v. 20 no. 1, 1955, p. 14-20.

Laboratory investigations on the factors effecting the intensity of the corrosive effect. Graphs, photographs, diagram. (R1, K general, ST)

**44-R. (Pamphlet.) Corrosion in Engine Cooling Systems Containing Aluminum: A Literature Survey.** Mildred Benton, compiler. Bibliography No. 5. 31 p. 1955. Naval Research Laboratory, Washington, D. C.

Bibliography covered the period 1926 to 1955, based on an investigation of other systems using aluminum-containing structures for cooling, and inhibitors used for such systems. (R4, R10, T25, Al)

**45-R. (Pamphlet.) The Corrosion Products of Iron and Steel: A Selected Bibliographic Survey With Abstracts.** Mary Jo Hoehm, compiler. Bibliography No. 3. 24 p. 1955. Naval Research Laboratory, Washington, D. C.

Covers periods from Jan. 1945 to Jan. 1955. (R2, Fe, ST)

# S

## Inspection and Control

**1-S. Limitations of Steel Specifications.** E. H. Snyder. *Metal Progress*, v. 68, Nov. 1955, p. 76-80.

Steel specifications can be misleading for the range is often too wide or some unmentioned property can cause processing difficulties. Tables, graphs, photograph. (S22, ST)

**2-S. Longer Life for Chromel-Alumel Thermocouples.** N. F. Spooner and J. M. Thomas. *Metal Progress*, v. 68 Nov. 1955, p. 81-85.

Errors that develop in Chromel-Alumel thermocouples can be minimized or prevented by inserting titanium as an oxygen getter, and hermetically sealing the assembly. Micrographs, tables, photographs. (S16)

**3-S. Determining Significant Differences.** C. H. Li. *Metal Progress*, v. 68, Nov. 1955, p. 104B, 105.

Simple method for evaluating differences in test results and determining whether they are real or due to chance alone. Nomograph. (S12)

**4-S. Radioactive Materials and Their Application in Industry.** A. D. Merriman. *Metal Treatment and Drop Forging*, v. 22, Oct. 1955, p. 433-437.

Considers applications encompassing ionization effect, radiography and tracer technique. Photographs, table, diagram. (S19, EG-h)

**5-S. Equipment Failure Due to Heat.** D. J. Bergman. *Petroleum Processing*, v. 10, Nov. 1955, p. 1729-1736.

Explains temperature gradient stress, its effects and its calculation; six metal failure problems and their solutions. Diagrams. 9 ref. (S21)

**6-S. Testing Welded Metal Joints.** S. W. Hollingum. *Metal Industry*, v. 87, Nov. 18, 1955, p. 429-432.

Nondestructive testing by gamma-ray, ultrasonic and electromagnetic flow methods. Photographs, diagrams. (S13)

**7-S. Optical Tooling Speeds Gage Set-Up.** W. L. Egy. *Metal-Working*, v. 11, Dec. 1955, p. 8-9.

Description and operation of the Brunson optical transit square. Techniques for accurately positioning large plates. Photographs, diagrams. (S14)

**8-S. Problems in Metrology.** C. Minaire. *Metalworking Production*, v. 99, Nov. 4, 1955, p. 1865-1871.

Solutions to measuring problems, including special gages for internal and external tapers and unusual uses of sine bars. Diagrams. (S14)

**9-S. Specifications for Mild Steels.** J. K. Honeyman. *Sheet Metal Industries*, v. 32, no. 343, Nov. 1955, p. 855-859.

Considers what should be included in a steel specification so that the purchaser may be protected without additional unnecessary testing. Photographs, micrographs, table. 2 ref. (S22, CN)

**10-S. Gamma-Radiographic Control of Welded Transmission Pipelines.** C. C. Bates. *Welding and Metal Fabrication*, v. 23, Nov. 1955, p. 420-426.

Increasing and successful application of iridium-192 radioactive sources together with welding supervision in United Kingdom. Photographs, diagrams, graphs, table. (To be continued.) (S19, K9, Ir)

**11-S. (Swedish.) A Method for Simultaneous Determination of Carbon and Sulfur.** Lars Bjerkerud. *Jernkontorets annaler*, v. 139, no. 19, 1955, p. 847-852.

Apparatus for simultaneous determination of carbon and sulphur in steel. Diagrams, photograph, tables. 5 ref. (S11, ST)

**12-S. (Polish.) Statistical Analysis of the Shape of Die Cast Test Pieces.** Aleksander Krupkowski, Zbigniew Lech and Jan Wozniacki. *Archiwum gornictwa i hutnictwa*, v. 3, no. 3, 1955, p. 317-344.

A five-fold test piece is proposed for the inspection testing of die cast alloys. A 2.5-fold test piece is recommended when it is possible to increase the thickness and gage length of test pieces. Diagrams, graphs, tables. 18 ref. (S12, E13, Q27)

**13-S. (German.) Application of Statistical Methods in Iron and Steel Works.** Gerolf Strohmeier and Hans Richter. *Stahl und Eisen*, v. 75, no. 22, Nov. 3, 1955, p. 1494-1501.

Calculation of variables and its importance in handling problems. Precise records are preliminary condition for application of mathematical-statistical methods. Diagrams, graphs. 3 ref. (S12)

**14-S. The Application of Radio-Frequency Induction Heating to the Determination of Total Carbon in Cast Iron and Other Ferrous Alloys.** W. E. Clarke and R. Rew. *British Cast Iron Research Association, Journal of Research and Development*, v. 6, Oct. 1955, p. 60-69 + 6 plates.

The analysis train arrangement is presented with some preliminary work on the effect of the catalyst. Work was done to establish the effect of different fluxes. Diagrams, tables, photographs. 3 ref. (S11, CI)

**15-S. Precise Measurement of the Diameter of Fine Wires.** I. G. Morgan. *Engineer*, v. 200, Nov. 4, 1955, p. 646-647.

Apparatus will measure fine wire up to about 0.01 in. in diam. to an accuracy of ± 0.00001 in. A pivoted beam carries an anvil which contacts the wire. The angle of tilt of the beam is measured by a mirror and autocillimator from which the wire diameter is determined. Diagrams, photograph. (S14)

**16-S. Magnetic Particle Inspection Standards.** John B. Caine. *Foundry*, v. 83, Dec. 1955, p. 84-89.

Acceptance or rejection of a casting should not depend solely on the presence of defects. Diagrams, graphs, photographs. 3 ref. (S13)

**17-S. Gas Analysis in Steel Mills.** R. R. Swain and J. A. Hays. *Instruments and Automation*, v. 28, Nov. 1955, p. 1940-1944.

Methods of adapting gas analysis equipment in steel mills. Graph, diagrams, photographs. (S11)

**18-S. Pinholes in Thin Steel and Pinhole Detecting Apparatus.** G. H. Rendel. *Iron and Steel Engineer*, v. 32, Nov. 1955, p. 57-64; disc., p. 64.

Review of pinhole detectors, discussion of new developments. Diagrams, photographs. (S13, ST)

**19-S. An X-Ray Tin Thickness Gage for the Electrolytic Tin Line.** R. R. Webster. *Iron and Steel Engineer*, v. 32, Nov. 1955, p. 65-71; disc., p. 71-72.

Gage can be mounted directly on the tinning line to give a continuous record of coating weight. Diagrams, graphs, photographs. 2 ref. (S14, L17, Sn)

**20-S. Reel Control Systems for Mills and Process Lines.** A. J. Winchester, Jr. *Iron and Steel Engineer*, v. 32, Nov. 1955, p. 125-134; disc., p. 134.

Magnetic amplifiers fit precision requirements for reel control in hot and cold rolling of metal strip. Graphs, diagrams, photographs. (S18, F23)

**21-S. International Standards for Wrought Light Alloys.** *Light Metals*, v. 18, Nov. 1955, p. 375-376, 377-379.

Tabulates ASTM specifications for aluminum and magnesium alloys and gives data for converting from trade designations to Aluminum Association coding. Tables. (To be continued.) (S22, Al)

**22-S. Characteristics of Investment Casting Alloys.** William W.

Lamb and W. Fred Carn. *Machine Design*, v. 27, Dec. 1955, p. 209-210.

Castability, mechanical properties, fabrication characteristics of various alloys. Tables. (S22, E15)

**23-S. Uses of Vibrational Waves in Metallurgical and Mineral Dressing Processes.** J. K. Almond. *Metal Treatment and Drop Forging*, v. 22, Nov. 1955, p. 475-480.

Industrial applications. Photographs, 46 ref. (S13, B14)

**24-S. Measurement of Fine Wire by Autocollimator.** I. G. Morgan. *Metalworking Production*, v. 99, Nov. 18, 1955, p. 1957-1959.

Reaches an accuracy of ± 0.00001 in. or better. Diagram, photograph. (S14)

**25-S. Flying Spot Microscope.** D. Causley and J. Z. Young. *Research*, v. 8, Nov. 1955, p. 430-434.

Outlines flying spot method and discusses counting of total numbers of particles of all sizes, as well as size distribution. Diagrams, photographs, tables. 4 ref. (S14, H11)

**26-S. On the Theory of Measuring Thickness by Absorption of Radioactive Rays.** A. M. Bogachev, B. I. Verkhovskii and A. N. Makarov. *Henry Brutcher Translation No.* 3602, 10 p. (From *Zavodskaya laboratoriya*, v. 21, no. 7, 1955, p. 808-812). Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 273-S, 1955. (S14, S19)

**27-S. Photometric Determination of Acid-Soluble and Acid-Insoluble Aluminum in Steel.** K. Wacykiewicz. *Henry Brutcher Translation No.* 3609, 5 p. (From *Biuletyn informacyjny (Hutnik)*, v. 6, no. 2, 1955, p. 7-8.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 78-S, 1955. (S11, Al, ST)

**28-S.** (French.) **Apparatus for Testing the Soundness of Metallic Pieces by Ultrasonic Echos.** M. Beaujard. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques*, v. 12, no. 10, 1955, p. 2013-2021.

Examines four different apparatuses using ultrasonic impulses: Hughes, Siemens, Metalloradar "L", and Krautkrämer. (S13)

**29-S.** (Russian.) **Polarographic Determination of Copper, Iron, Cadmium, and Lead in Zinc.** *Collection of Czechoslovak Chemical Communications*, v. 26, no. 4, 1955, p. 858-862.

Polarographic effect of above elements in 0.08 *N* ethylenediaminetartrate and 0.08 *N* potassium pyrophosphate solutions in presence of higher zinc concentration. A practical application of a method for determination of copper, iron, lead, and cadmium in zinc, zinc dust and zinc alloys suggested. Table, graphs. 15 ref. (S11, Cd, Cu, Fe, Pb, Zn)

**30-S.** (Book.) **ASTM Specifications for Steel Piping Materials.** 425 p. 1955. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $4.00.

Specifications for pipe, tubes, castings, forgings, and bolting. (S22, ST)

# T

## Applications of Metals in Equipment

**1-T. Nimonic Alloys and Other Heat-Resistant Materials in Sheet Form.** H. E. Lardge. *Metal Treatment and Drop Forging*, v. 22, Oct. 1955, p. 445-448.

Reviews position and details of some nickel-base alloys and stainless steels used in modern aircraft. Photographs, table. (T24, SS, Ni-g)

**2-T. Problems in Materials for Nuclear Power.** John P. Howe. Paper from "Nuclear Metallurgy". IMD Special Report Series No. 1. American Institute of Mining and Metallurgical Engineers, p. 9-28.

Considers environmental requirements, design and development of components and processes, and their interaction in the reactor. Eight reactor schemes studied. Graphs, diagrams, tables, photographs. 24 ref. (T25)

**3-T.** (Japanese) **Anti-Corrosive Copper Alloys for Boiler Parts of Steam Locomotives.** Toshio Saito, Kazuo Ohyama and Yorihisa Yoshinari. *Journal of Railway Engineering Research (Japan)*, v. 12, no. 15, Aug. 10, 1955, p. 371-387.

New machining method will permit use of naval brass which exhibits absence of crystallization compound of base metal other than copper and great hardness. Micrographs, photographs, graphs, diagrams, tables. (T25, R4, G17, Cu)

**4-T. Selection, Care, and Installation of Anti-Friction Bearings.** E. P. Stahl. *Machinery*, v. 62, Nov. 1955, p. 166-175.

Explains classification and discusses miniature ball, roller and other types. Diagrams. (T7, SG-c)

**5-T. Spheroidal-Graphite Cast Iron Dies and Tools for the Sheet-Metal Industries.** A. B. Everest. *Sheet Metal Industries*, v. 32, no. 343, Nov. 1955, p. 805-812.

Review of spheroidal-graphite cast iron as used in tools. Photographs, table. (T5, CI)

**6-T. The Use of Tungsten Carbide in the Sheet-Metal Industry.** B. Elliott and J. Evans. *Sheet Metal Industries*, v. 32, no. 343, Nov. 1955, p. 813-821.

Discusses higher production runs achieved where components are produced with the use of tungsten carbide dies and die inserts. Diagrams, photographs. (T5, W)

**7-T. The Use of Hard Aluminium Bronze as a Material for Press Tools.** S. C. Jones. *Sheet Metal Industries*, v. 32, no. 343, Nov. 1955, p. 822-825; disc., p. 825-828, 830.

Discusses Narite dies for use in pressing and drawing. Photographs. (T5, T6, G1, G4, Cu)

**8-T.** (Hungarian.) **Economic Design of a Transformer With Aluminium Windings.** Kalman Saringer. *Elektrotechnika*, v. 48, no. 10, Oct. 1955, p. 306-309.

All characteristics of a transformer are determined in relation to a circle drawn around the iron core; approximates the ratio between the flux and the number of turns. Diagram, graphs, tables. (T1, Al, Cu)

**9-T. Low Voltage Nickel-Chromium Elements for Heat Treatment.** *Canadian Metals*, v. 18, Nov. 1955, p. 22-23.

Corrtherm elements have a tightly adhesive oxide coating and high-temperature enamel which enable a furnace to be operated at high temperature and low voltage. Photographs. (T5, J general, Ni, Cr)

**10-T. The Development of an Electrode for Metal Arc Welding of Wrought 35 Ni-15 Cr-1¼ Si Alloy.** Paul Goetcheus and Rollo Boring. *Industrial Heating*, v. 22, Nov. 1955, p. 2282 + 10 pages.

A rod known as RA-330-80 was found best for use in welding the alloy. Photographs, diagram, table. 7 ref. (T5, K1)

**11-T. Research—As Applied to Some Metallic Materials for the Petroleum Industry.** B. B. Morton. *Mines Magazine*, v. 45, Oct. 1955, p. 115-118, 128.

An outline of research carried on by the International Nickel Co., Inc. Photographs, table, graphs. (T28, AY, Ni, Cu)

**12-T. Noral Snaprib Roofing Sheet.** *Modern Metals*, v. 11, Nov. 1955, p. 58.

Installed with continuous snap-joint and concealed clips, new material provides leak-proof cladding without holes or exposed fasteners; sold in 20-ft. lengths and three finishes. Photograph. (T26, Al)

**13-T. Coming Up: The Big Applications of Aluminum in Automobiles.** Leo Swoboda. *Modern Metals*, v. 11, Nov. 1955, p. 62, 64, 66.

Present and future uses of aluminum for anodized colored trim parts, radiators, engines, structural elements. Table, photographs, diagram. (T21, Al)

**14-T. Glass-Aluminum Towers.** *Modern Metals*, v. 11, Nov. 1955, p. 72, 74, 76.

New apartment projects on Chicago's lakefront to employ unique curtain wall grids made of anodized aluminum extrusions and tinted glass. Design factors and installation procedures. Photograph, diagrams. (T26, Al)

**15-T. Ferrous Materials in Marine Engineering.** S. F. Dorey. *North East Coast Institution of Engineers & Shipbuilders, Transactions*, v. 72, Nov. 1955, p. 27-56.

New fabrication and treatment processes reviewed. Tables. 21 ref. (T22, Fe)

**16-T. Ductile Iron—A New Material for Petroleum Pipe.** Maurice Grandpierre and C. C. Reynolds. *Oil and Gas Journal*, v. 54, Nov. 21, 1955, p. 192-194, 197.

Mechanical and physical properties of ductile iron that would be advantageous in petroleum pipe. Graph, micrographs, photographs, tables. 6 ref. (T28, Q general, CI)

**17-T. Hydramatic Shifts Gears.** Floyd G. Lawrence. *Steel*, v. 137, Nov. 28, 1955, .p 79-80.

Advantages, fabrication and aluminum applications in hydraulic transmission. Photograph. (T21, G17, ST, Al)

**18-T. A Missing Link for Chain.** H. F. Reid, Jr. *Steel*, v. 137, Dec. 12, 1955, p. 100-101.

Uses, advantages, description, specifications for welded aluminum chain. Photographs, tables. (T7, Al)

**19-T. Zirconium and Its Application to Nuclear Reactors.** H. Etherington, R. C. Dalzell and D. W. Lillie. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 1-18.

Nuclear properties, advantages, uses of zirconium alloys in reactors. Graphs, table. 11 ref. (T25, Zr)

**20-T. Application of Zirconium for Other Uses.** R. I. Jaffee. Paper from "The Metallurgy of Zirconium". National Nuclear Energy Series, Division VII—v. IV. McGraw-Hill Book Co., p. 19-49.

Advantages and uses of zirconium alloys and compounds in chemical and electrical equipment, as an alloying addition, and in miscellaneous applications. Photographs, tables, graphs, diagram. 66 ref. (T29, T1, Zr)

**21-T.** (French.) **High-Strength Cast Irons for Diesel Engines.** C. R. Van Der Ben. *Fonderie*, 1955, no. 116, Sept., p. 4671-4679; disc., p. 4680.

Survey of physical characteristics, production processes, quality, production costs as factors in selection. Tables, micrographs, photographs. (T25, CI)

**22-T.** (French.) **Economic Advantages of Aluminum Conductors in Rural Electrification Lines.** A. Dalmasso. *Revue de l'aluminium*, v. 32, no. 224, Sept. 1955, p. 831-838.

Cost comparison between aluminum and copper shows estimated 20% savings. Emphasizes durability and lack of technical problems. Tables, graphs. (T1, Al, Cu)

**23-T.** (Hungarian.) **The Manufacture of Carbide Drill Bits in Hungary. Development of a New Branch of Industry.** György Adorjan. *Banyaszati lapok*, v. 10, no. 10, Oct. 1955, p. 545-548.

Investigates material and production methods, pilot-plant production, experiences of large-scale manufacture. Diagram, table, graph, photographs. (T6, C-n)

**24-T.** (Russian.) **Low-Alloy Steel 18DGS-L for Detailed Casting of Components in Hydraulic Installations.** I. R. Krianin and G. I. Babushkina. *Metallovedenie i obrabotka metallov*, 1955, no. 2, Aug., p. 28-32.

Relation of crystal lattice parameter of quenched copper-manganese-silicon steel to copper content; relation between cavitation resistance and carbon content. Tests of other properties, including strength, plasticity and resistance to corrosion show this group of steels may substitute for certain cast high-chromium steels in turbine parts. Graphs, table, photographs. (T4, M26, Q general, R general, CI)

**25-T.** (Book.) **Constructional Steelwork.** Oscar Faber. 368 p. 1955. Philosophical Library, 15 East 40th St., New York 16, N. Y. $12.00.

Based on latest British regulations for use of structural steel in building. Consideration is given to the elementary principles of design, materials, properties, specifications, working stresses, connections, and welding. (T26, ST)

**26-T.** (Book.) **Curtain Walls of Stainless Steel.** 188 p. 1955. School of Architecture, Princeton University, Princeton, N. J.

Examples of stainless steel usage in buildings; design factors; structural properties. (T26, Q23, SS)

**27-T.** (Book.) **Nuclear Metallurgy.** IMD Special Report Series No. 1. 126 p. 1955. American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York 18, N. Y. $3.75.

Papers presented at a recent symposium covering power reactors; problems in materials for nuclear power; plutonium metal; physical metallurgy of thorium and uranium. (T25, P general, Th, Pu, U)

# V

## Materials

### *General Coverage of Specific Materials*

**1-V. New Aluminium-Vanadium-Titanium Alloy.** *Metal Treatment and Drop Forging*, v. 22, Oct. 1955, p. 430-431.

Mechanical and high temperature properties, weldability. Photograph, table, graphs. (Q general, K9, Ti, Al, V)

**2-V. Titanium.** C. Fred Curnham. *Products Finishing*, v. 20, Nov. 1955, p. 60 + 8 pages.

Present commercial and electrolytic recovery processes, costs, producers, uses, electrodeposition considered. (Ti)

**3-V. Plutonium Metal.** Eric R. Jette. Paper from "Nuclear Metallurgy". IMD Special Report Series No. 1. American Institute of Mining and Metallurgical Engineers, p. 29-37.

Data released to May 1955, physical and metallurgical properties, equipment for handling it. Photographs, tables. 3 ref. (Pu)

**4-V. The Physical Metallurgy of Thorium.** H. A. Wilhelm and B. A. Rogers. Paper from "Nuclear Metallurgy". IMD Special Report Series No. 1. American Institute of Mining and Metallurgical Engineers, p. 39-63.

Current interest in thorium is due to its possible use as a source for nuclear fuel. Metallurgical, physical, and mechanical properties presented. Graphs, micrographs, diagram, tables. 82 ref. (P general, Q general, Th)

**5-V. Titanium and Titanium Alloys Programs.** v. I, II, and V. 35, 89, and 69 p. 1955. Air Materiel Command, Wright-Patterson Air Force Base, Ohio.

Provides wide dissemination of unclassified information in abstracted form. (Ti)

**6-V.** (German.) **Cold-Rolled Transformer Steel.** Fritz Stäblein and Hans-Heinz Meyer. *Elektrotechnische Zeitschrift*, v. 7, Ausgabe B, no. 10, Oct. 1955, p. 368-373.

Magnetic properties, methods of production, applications, advantages over hot rolled steel. Graphs, diagrams, photographs. 5 ref. (P16, T general, SG-p, Fe-q)

**7-V. Thorium.** James W. Franklin and Daniel P. Eigo. *Engineering and Mining Journal*, v. 156, Nov. 1955, p. 75-77.

Raw material sources, methods of processing, applications, markets and general review of major thorium minerals. Photographs, tables. (Th)

**8-V. Nickel-Copper Low Alloy Steels.** T. N. Armstrong and J. W. Crossett. *INCO*, v. 26, no. 6, Oct. 1955, p. 12-17.

Composition, mechanical properties, formability, welding and corrosion resistance. Tables, graphs, photographs. (AY)

**9-V. Iodide Process Produces Ductile Hafnium for Fabrication.** J. G. Goodwin and W. J. Hurford. *Journal of Metals*, v. 7, Nov. 1955, p. 1162-1168.

Melting techniques, ingot quality, forging, strip, rod and wire fabrication extrusion, cold rolling, machining, welding, annealing. Tables, photographs graphs, diagram. 13 ref. (Hf)

**10-V. Fabricating Ultra - High Strength Steel.** John Dietz and L. H. McCreery. *Product Engineering*, v. 26, Dec. 1955, p. 170-173.

Heat treatment, plating, machining, casting specifications for SAE 4340 steel to assure strength and reliability. Tables, photographs. (AY)

**11-V. High-Nitrogen Steels: New Stainless Family.** D. J. Carney. *Steel*, v. 137, Nov. 7, 1955, p. 138, 140, 144.

Processing and application of a new austenitic stainless, made without nickel, which is completely austenitic at 2300° F. Key to its stability at high temperatures is a nitrogen content more than double previous limits. Graphs. (SS)

**12-V. The Thorium and Cerium Industries. I. Thorium. II. Cerium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 327-346.

Natural occurrence, extraction from ores, analysis of minerals, properties, uses. 18 ref. (Ce, Th)

**13-V. Titanium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 347-353.

Kinds and locations of ores, preparation, properties, utilization of metallic titanium and its compounds. 24 ref. (Ti)

**14-V. Zirconium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 355-359.

Short review of geographic distribution, extraction and analysis of ores, industrial and other uses, price. Table. 12 ref. (Zr)

**15-V. Tantalum and Niobium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 361-366.

Location and composition of ores, manufacture, properties, and uses of tantalum, analysis of minerals, estimation of columbium in steels. Table. 3 ref. (Cb, Ta)

**16-V. Tungsten.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 367-372.

Natural occurrence, distribution, extraction from ores, properties, uses of metals, ore analysis. (W)

**17-V. Uranium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 387-391.

Characteristics, manufacture, uses of metal, treatment of ores, geographic occurrence of radioactive ores. Table. (U)

**18-V. Vanadium.** Norbert Berkowitz. Paper from "Industrial & Manufacturing Chemistry. Pt. II. Inorganic". v. II. Philosophical Library, Inc., p. 393-398.

Two methods of extraction from ores and two methods of analyzing ores and alloys; properties and uses of metal and its compounds. (B general, V)

**19-V. The Lithium Industry.** P. E. Landolt. *Electrochemical Society, Journal*, v. 102, Dec. 1955, p. 285C-287C.

Reviews growth of U. S. industry, raw materials, processing, uses and economics. Tables. 27 ref. (A general, Li)

**20-V. Rhenium.** C. T. Sims, *Metal Industry*, v. 87, Nov. 4, 1955, p. 381-383.

Account of recent research in fabrication, properties and applications. May be used as electrical contacts, electron tube filaments, contacts in marine engine magnetos, whiskers for transistors, and as a wear resistant material. Photograph, table, graphs. 6 ref. (T1, Rh)

**21-V. Tellurium.** J. Lomas. *Mine & Quarry Engineering*, v. 21, Dec. 1955, p. 508-509.

Properties, distribution, production, uses. (Te)

**22-V.** (Book.) **The Metallurgy of Zirconium.** Benjamin Lustman and Frank Kerze, Jr., editors. National Nuclear Energy Series, Division VII—v. IV. 776 p. 1955. McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y.

Covers extraction, properties, applications, fabrication, and metallography of zirconium and its alloys. Papers individually abstracted. (Zr)

**23-V.** (Book.) **Tungsten.** K. C. Li and Chung Yu Wang. American Chemical Society Monograph No. 94. 3rd Ed. 506 p. 1955. Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. $14.00.

Comprehensive up-to-date exposition of the history, geology, ore-dressing, metallurgy, chemistry, analysis, applications, and economics of the metal. (W)

# EMPLOYMENT SERVICE BUREAU

**The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.**

## POSITIONS OPEN

### Midwest

**ANALYTICAL CHEMIST: Assume full charge of mill laboratory in steel industry directing activities of 50 to 60 employees in wet chemical and spectrographic analysis of alloy and stainless steels. Some research and development work. Applicant must have heavy supervisory experience and be able to demonstrate managerial abilities. Our organization knows of this ad. Send complete resume of experience and personal history. Box 1-5.**

METALLURGIST: Large gray iron foundry in Central Wisconsin. To be responsible for cupola melting, metal control, laboratory supervision. Also experience required in electric furnace practice. Give personal history, references and salary expected. Box 1-10.

CHIEF METALLURGICAL ENGINEER: Challenge for an aggressive metallurgist with college degree, to analyze and develop new ideas in the heat treating of machined parts. Permanent position. Excellent salary. Write to: R. R. Giesser, Cleveland Rock Drill Plant, Le Roi Division, Westinghouse Air Brake Co., 12500 Berea Rd., Cleveland 11, Ohio.

METALLURGICAL ENGINEER: Opening for young graduate with two to five years experience in either ferrous or nonferrous foundry practice. Permanent position with aggressive precision molding foundry. Ample opportunities for promotion and to develop basic metallurgical background. Modern plant located in large city near excellent institutions where graduate studies can be continued. Box 1-15.

METALLURGICAL ENGINEER: For sales engineering position with nationally known steel distributor. Want young man to train for vital sales position. Work is interesting combination of sales, service, consulting and general company representation. Challenging opportunity with outstanding possibilities. Please write furnishing resume. Box 1-20.

INSTRUCTORS: To teach graduate and undergraduate physics of metals, physical metallurgy, needed for February or September 1956. Salary and rank dependent on qualifications. Apply: L. F. Mondolfo, Metallurgical Engineering Dept., Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

**TITANIUM METALLURGIST: Either experienced man or one interested in entering this field covering titanium production in mill converting to bars, forgings, sheet, strip and wire. Work will include both the technical and production aspects of material. Send information on education, experience, age, references, etc. Box 1-25.**

**METALLURGICAL GRADUATES: Openings in mill production metallurgical group and laboratory in mill producing high speed steels, toolsteels, stainless, high-temperature alloys and many specialty steels. Will consider both experienced men and recent graduates interested in these fields. Reply giving details of education, experience, age, references, etc. to: Personnel Dept., Universal-Cyclops Steel Corp., Bridgeville, Pa.**

METALLURGICAL ENGINEER: With B.S. degree in metallurgical or chemical engineering, or metallurgy, to act as mill methods man, the technical representative of works manager in mill operating department. To establish material specification, operation sequence, processing standards and quality checks so end product meets all requirements. Opportunity for advancement. Write to: Byron A. Grove, Employment Manager, Revere Copper and Brass Inc., 2200 North Natchez Ave., Chicago 35, Ill.

SALESMAN: Full time or with only one other line. By metal working and heat treating oils and compound manufacturer. Generous commissions. Protected territory. Quality repeat products. Good income possibilities for man who likes to work out problems in plants. Box 1-115.

DIRECTOR OF METALLURGY: Well-known automotive company is seeking qualified graduate metallurgist to direct chemical and metallurgical laboratory. Must have extensive background in ferrous metals and heat treating. Requires aggressive individual with supervisory experience to direct both production and research development work. Salary commensurate with ability and experience. Send complete resume including education, experience, salary requirements, etc., together with a small photograph. Replies held in strict confidence. Box 1-120.

### East

UNUSUAL OPPORTUNITY: In metallurgical department of leading instrument manufacturer for man with B.S. degree in metallurgical engineering or equivalent. Broad scope of work, including design and metallurgy development projects and manufacturing problems. Exceptional opportunity for individual development. Company and community environment excellent. Box 1-30.

ENGINEER: Graduate, to work in the research-development department of medium-size, well-established stamping company situated in heart of New England. Applicant needs metallurgical experience, two to three years, involving technical and production aspects of materials. Salaries, promotions, in keeping with individual accomplishments. Applications handled promptly and confidentially. Box 1-125.

PLANT MANAGER: Fast-growing specialty rolling mill in New York area requires man thoroughly familiar with rolling, annealing and slitting practice. Products include clad metals, most types of precision rolled ferrous and nonferrous metals. Must be a capable executive. Unusual opportunity for man with ability to get things done. Send resume in full confidence. Box 1-130.

METALLURGICAL LITERATURE SPECIALIST: Person with advanced degrees, coupled with industrial or teaching experience, to make searches and critical reviews of the technical literature in a program of advanced literature research. Fields of metallurgy, applied mechanics and/or electrical engineering. Send resume to: Edw. H. Elliott, General Electric Main Library, Schenectady 5, N. Y.

METALLURGIST: As process metallurgist in brass mill manufacturing beryllium-copper, phosphor-bronze and nickel-silver in the form of strip, wire and rod. Reply fully in writing giving age, experience and salary desired to: Personnel Dept., The Riverside Metal Co. Division, H. K. Porter Co., Inc., Riverside, N.J.

METALLURGIST: To perform development and process work under supervision of chief metallurgist. This is not a routine job, salary and advancement will depend upon the individual. Direct reply to: R. N. Anderson, Personnnel Manager, Seymour Manufacturing Co., Seymour, Conn.

METALLURGIST: Man with at least an M.S. degree in either physics or metallurgy, for X-ray diffraction work with high-temperature alloys, for use in identification of various phases of the solution of high-temperature alloy problems. Familiarity with electronic diffraction techniques desirable. Salary $8000. Send resume to: T. S. Woerz, Small Aircraft Engine Dept., General Electric Co., 1000 Western Ave., West Lynn, Mass.


**JET PROPULSION LABORATORY**

**OF THE**

**CALIFORNIA INSTITUTE OF TECHNOLOGY**

*Pasadena, California*

**jpl** offers opportunities in materials research

**CERAMISTS OR CHEMISTS**

for basic research on high-temperature ceramic and cermet systems. Studies of phase relationships, solid state and gas reactions, and thermal and mechanical properties of oxides, nitrides, carbides, borides, and other materials, including graphite.

**SOLID STATE PHYSICISTS OR PHYSICAL METALLURGISTS**

for basic research, primarily on metals. Studies of mechanisms of deformation and fracture at high temperatures in single crystal and polycrystalline materials, imperfections in metallic lattices, radiation damage, and related problems.

**METALLURGISTS OR MECHANICAL ENGINEERS**

for research and development on high-temperature materials, titanium, and other metals and non-metals for use in jet engines and rockets.

**METALLURGISTS**

for research studies on materials of interest in nuclear propulsion.

Openings exist at BS, MS and PhD levels. Airmail your summary of qualifications to:

**CALTECH | JET PROPULSION LABORATORY**

**4800 Oak Grove Drive, Pasadena, California**

**a place where**

*Creativity*

**is encouraged and prized**

ARMOUR RESEARCH FOUNDATION is one of the nation's largest and most progressive research organizations.

The Foundation was created some twenty years ago to provide research and development services to industry and government. How well it has fulfilled this purpose is reflected in its remarkable growth.

One of the key factors in Armour Research Foundation's success has been engineering and scientific teamwork. Intensive collaboration, utilizing highly skilled and diversified talents, is focused upon a particular problem to reach a solution.

The Foundation has been able to gather together an outstanding staff because—in addition to encouraging and prizing creativity—it has a competitive pay scale, good insurance and pension plans, variety of work, excellent facilities, and opportunities for personal and professional advancement.

These also are the reasons why more and more scientists and engineers are looking to Armour Research Foundation as the place to build their careers. Write to the Personnel Manager if you are interested in openings as:

**METALLURGISTS**

**Extractive & Ore Dressing**
**Welding & Brazing**
**Powder**
**Non-Ferrous Alloy**
**Nuclear**
**Physical**
**Mechanical**
**Electrochemical & Corrosion**
**Applied**
**Extractive and Ore Dressing**
**Welding and Brazing**
**Electrochemical and Corrosion**

ARF

**ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY**

Room 304C 10 W. 35th Street Technology Center Chicago 16, Ill.


**West**

METALLURGIST or METALLURGICAL ENGINEER: Nondestructive testing using X-ray, ultrasonic, etc. methods, to develop a quality control program using specialized inspection techniques for all materials and parts. Graduate with two to five years experience desired, who wishes broader experience. Company is expanding pioneer of solid and liquid rocket motors, etc. Box 1-35.

## POSITIONS WANTED

METALLURGICAL ENGINEER: B.S., M.S., Ph.D. degrees, age 32, married, family, veteran. Ten years university teaching and research experience. Ten publications in field of ferrous mechanical metallurgy, weldability, transformations. Three years full-time industrial employment during undergraduate study. Desires senior university post with research opportunities or industrial research. Box 1-40.

METALLURGIST: B. Ch.E. degree, age 39, married, family. Experience includes 5½ years in nonferrous field, 8½ years in material and process laboratory related to light manufacturing (6 years in laboratory supervision) and 1 year in electroplating. Production trouble shooting in each field. Desires position of responsibility as chief metallurgist or director of laboratory. Salary $650/mth. minimum. Box 1-45.

SALES ENGINEER: With 17 years experience in sales and metallurgical engineering. Customer contacts in Detroit area. Desires position with automotive parts manufacturer. Research and development, new processes and products in ferrous, nonferrous powdered metals field. Box 1-50.

METALLURGIST: Ph.D. degree, age 35. Twelve years in fabrication of nonferrous, light and nuclear metals. Experience as plant metallurgist, assistant professor of metallurgy, and in nuclear metal research and development. Desires position of directing metallurgical activities in midwest or western location. "Q" cleared. Box 1-55.

FOUNDRY METALLURGIST, SUPERINTENDENT: With 12 years diversified experience in all phases foundry. Young, college education, ambitious, pleasing personality, works well with others. Employed at present. Desires association with progressive foundry company in management position. Proven background and can furnish excellent references. Prefers south or west but will consider other location. Box 1-60.


**WANTED**

**Metallurgist**

**Metallurgical Engineer**

Opportunity for responsible and challenging work in Research and Development for recent or experienced graduate with B.S., M.S. or Ph.D. degrees.

Background in powder metallurgy desirable. Metallurgical projects include metal bonds for grinding wheels, ceramics to metal coatings, cermets, effect of grinding on metal surfaces and many other new developments.

Send Resume to

**Mr. Frank Zacher**
**Director of Personnel**
**Norton Company**
**29 New Bond Street**
**Worcester 6, Mass.**

NORTON

**ABRASIVES • REFRACTORIES**
**GRINDING WHEELS & MACHINES**

METALLURGICAL ENGINEER: M.S. degree, age 32, single. Five years diversified experience in research and development, materials application, heat treating, testing and specification work with ferrous and nonferrous metals. Foreign languages. Desires challenging responsible position with opportunity for advancement. Box 1-65.

PRODUCTION SUPERVISOR: B.A. degree in physics. Experienced in aluminum casting, rolling, extrusion and quality control. Supervised both production and research. Currently employed as technical director of research company. Married, veteran, age 28. Desires challenging permanent position with progressive company. Box 1-70.

WORKS MANAGER: Metallurgical engineer, age 37, experienced in ferrous and nonferrous fields, job shop and mass producing industries. Heavy administrative and accounting background. Previous and present employment with national companies. Desires responsible production position. Salary presently over $10,000. Complete resume on request. Box 1-75.

METALLURGIST: Age 26, married, five years diversified experience in metallurgical laboratory of large electrical manufacturer, including mechanical testing, metallography and evaluation and development of heavy forging alloys. Desires position with small manufacturing concern where engineering degree is not essential for advancement. Prefers Eastern Seaboard. Box 1-80.

METALLURGICAL ENGINEER: Age 31, married, M.S. degree. One year electrical heating element industry, one year teaching as metallurgy instructor, two years in development and process control of steel cartridge case program, two years in laboratory of refractory powder metals producer. Experience in processing, heat treatment, chemical and mechanical testing, metallography, quality control and failure analysis. Capable of initiating and supervising laboratory. Wisconsin-Minnesota-Michigan region preferred. Minimum salary $8000. Box 1-85.

METALLURGICAL ENGINEER: Age 37, married. Supervisory level experience in fields of high-temperature alloy fabrication, nonferrous materials engineering, nonferrous foundry. Director of laboratory performing metallography, physical testing, spectrography, X-ray. Desires work requiring administrative ability and technical background in medium-size industry with challenging problems. Present salary $8500. Box 1-90.

CHIEF METALLURGIST or TECHNICAL SALES: Age 35, married, M.S. degree in metallurgical engineering. Twelve years diversified experience in foundry work including production as well as technical responsibility in heat resisting alloy and precision casting fields. Located Midwest, will consider change of location. Box 1-105.

MANAGER: Nonferrous fabrication and extrusion. Age 42, married, small family. Fifteen years heavy practical experience all phases production control, machine maintenance, tool and die engineering, ingot casting, customer contacts, labor relations. Desires position as manager or superintendent of small or medium plant. Midwest preferred. Best references. Box 1-135.

## RESEARCH METALLURGISTS

**Research and development engineers with experience and a desire to use their talents are needed for challenging work in the fields of alloy development, primary metal forming and metal processing.**

**These new positions in the Department of Metallurgical Research, Kaiser Aluminum and Chemical Corp., have been created as a result of a current research expansion to meet the demands of the rapidly expanding aluminum industry. Attractive salaries, insurance and retirement benefits. Expenses connected with interview and relocation will be paid.**

**For further information and application forms, please write to:**

**M. C. Fetzer**
**Depart. of Metallurgical Research**
**Kaiser Aluminum and Chemical Corp.**
**Spokane 69, Wash.**

**Replies will be held confidential.**

# engineers

## to develop a

## NUCLEAR AIRCRAFT ENGINE

**mechanical engineers**
for experimental testing and development, mechanical design, stress and vibration analysis, combustion research, heat transfer and nuclear reactor development.

**aeronautical engineers**
to work on innumerable internal and external airflow problems in connection with design, development and testing of a nuclear engine and its components.

**engineering physicists**
to assist in nuclear reactor design and development, including the analysis and development of controls, systems and instrumentation.

**metallurgists**
to develop and evaluate high temperature materials to get greater strengths at elevated temperatures and higher strength-weight ratios. Development of superior materials with greater corrosion resistance is of major importance.

**chemical engineers**
to investigate the chemical aspects of heat-producing and heat-transferring materials. Work will include the determination of phase and equilibrium diagrams and extensive analytical studies.

*General Requirements:*
At least a B.S. degree and up to five years' professional experience.

Send resume immediately to
Mr. Paul Smith, Office 16, Employment Department.

**PRATT & WHITNEY AIRCRAFT**
DIVISION OF UNITED AIRCRAFT CORPORATION
East Hartford 8, Connecticut

*World's Foremost Designer and Builder of Aircraft Engines*

## RESEARCH AND DEVELOPMENT

Expanding Pittsburgh Research Lab of a large manufacturer of Specialty Steels has openings for qualified metallurgists providing attractive income and benefits with opportunity for creative development and professional advancement.

Positions are available for metallurgists holding B.S., M.S. and Ph.D. degrees. Research includes all fields of Ferrous Metallurgy.

Send confidential resume and salary requirements to:

**CRUCIBLE STEEL COMPANY OF AMERICA**

Attention: A. A. Marquer, Jr.
Company Supervisor of Employment
Henry W. Oliver Building
Pittsburgh, Pa.

## METALLURGISTS

. . . needed by world's foremost manufacturer of rotary wing aircraft. Must be college graduate, able to assume responsibility for the preparation of specifications, standards, and reports for use in the design and manufacture of helicopters.

Successful applicants will enjoy the many benefits, both personal and professional, offered by a liberal and highly progressive organization.

Please send a complete resume to
R. M. Auten,
Personnel Department

ONE OF THE DIVISIONS OF UNITED AIRCRAFT CORPORATION

**SIKORSKY AIRCRAFT**
BRIDGEPORT 1, CONNECTICUT

## *Quality Control Can Help You*

Here is the information that drew capacity attendance to the Philadelphia Chapter's educational course on statistical quality control. Reported in 36 pages, these lectures have a down-to-earth value that you can apply in your job in production, engineering and inspection. Principles of its technique and examples of its use are described clearly and concisely in—

## *Practical Uses of Statistical Quality Control in Metal Industries*

- Units for Measuring Variations in Measurements
- Correlation of Test Data
- The Practical Uses of Statistical Quality Control in Metallurgical Plants
- Some Applications of Statistical Analysis in the Steel Industry

**PRICE . . . . . $1.50**

*Order from*
**American Society for Metals** 7301 Euclid Ave., Cleveland 3, Ohio

## METALLURGISTS
## CHEMIST PHYSICISTS
## ENGINEERS

The Semiconductor Products Department of Motorola Inc. has a number of attractive positions for metallurgists, physical chemists, inorganic chemists and physicists.

Openings exist in the fields of Materials Research and Device Development and in all phases of Semiconductor Device Production.

The Research and Production facilities are located in Phoenix, Arizona—excellent living conditions and opportunities for healthful outdoor recreation.

Applications should include age, education, experience, salary desired and photograph. Please send complete resume to:

**Director of Research**
**Semiconductor Products Dept.**
**Motorola Inc.**
**Phoenix, Ariz.**

# NEW!

**Published Late Summer 1955**

## THE BOOK YOU NEED FOR 1956
# *BERYLLIUM*

Beryllium—What about its fabrication, its properties, its corrosion? What about beryllium in its pure form?

These and many other questions are answered in this remarkable new book, "The Metal Beryllium".

38 authorities are represented in this volume, published as a result of a special symposium given at the A.S.M. mid-winter meeting in Boston, and sponsored in cooperation with the Atomic Energy Commission. D. W. White, Jr., and J. E. Burke of the Knolls Atomic Power Laboratory of General Electric edited the 38 chapters of the symposium, plus 15 additional papers covering certain aspects of beryllium in greater detail.

Contents include an introduction, the importance of beryllium, occurrence of ores and their treatment, reduction to metal, processing and fabrication, properties, the brittleness problem, metallography, corrosion, beryllium-rich alloys, cermets and ceramics, health hazards and analytical chemistry of beryllium.

6 x 9 Red Cloth 700 pages $8.00

**AMERICAN SOCIETY FOR METALS**
**7301 Euclid Avenue, Cleveland 3, Ohio**

# HERE'S HOW . . .

***To get copies of articles annotated in the A.S.M. Review of Current Metal Literature***

## Two alternative methods are:

**1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A list of addresses of the periodicals annotated is available on request.**

**2. Order photostatic copies from the New York Public Library, New York City, from the Carnegie Library of Pittsburgh, 4400 Forbes St., Pittsburgh 13, Pa., or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.**

**Write to Metals Review for free copy of the address list**

# METALS REVIEW

**7301 Euclid Avenue Cleveland 3, Ohio**

## AN INVITATION TO HEAT TREAT SALES ENGINEERS

This established furnace manufacturer has openings in certain territories for sales engineers who are presently calling on users of heat treating equipment. Other lines may be handled as long as they are non-competitive. This is an opportunity to add to your line the furnace equipment of a furnace manufacturer which will give you full engineering assistance and back you with national trade paper promotion. Get the complete information on working arrangements and specific territory by writing a confidential letter to: Tom A. Waltz, President, Waltz Furnace Co., 1901 Symmes St., Cincinnati, Ohio.

## METALLURGICAL ENGINEERS

Some experience helpful but not necessary for research and development work in atomic energy field. Work includes development of nuclear fuel alloys, fabrication of fuel elements and the bonding of fuel elements to various corrosion resistant cladding materials. Excellent benefits. Top salaries paid. Send resume to:

**Box 1-110, Metals Review**

## Wanted to Buy

Used recent-model tensile testing machine either 60,000, 100,000 or 200,000-lb. capacity.

**Box 1-140, Metals Review**

METALLURGISTS:

# CAREER OPENINGS in ATOMIC POWER

Westinghouse has just received additional new contracts to develop, design and build atomic power plants to propel naval vessels. That means unusual professional openings for a few talented metallurgists interested in these areas:

## BASIC RESEARCH

- Physical Metallurgy
- Corrosion and Radiation Effects on metals

## APPLIED RESEARCH

- Materials for Reactor Fuel Components
- Processes for fabricating Fuel Elements
- Powder Metallurgy
- Metal Working techniques

## NON-DESTRUCTIVE TESTING

Develop methods of inspecting critical parts of reactors using Ultrasonic, eddy-current and radiographic techniques.

## EVALUATION

- Materials
- Processes

Previous experience in nuclear power is *NOT REQUIRED* for many of these jobs.
Salaries open, depending on education and experience. Location in Suburban Pittsburgh. Attractive Housing available. New Atomic Education Program.

Send Resume to:

**Mr. A. M. Johnston**
**Westinghouse Bettis Plant**
**P.O. Box 1468**
**Pittsburgh 30, Penna.**

---

**RESEARCH AND DEVELOPMENT**

## METALLURGISTS AND METAL PHYSICISTS

We are looking for scientists and engineers who are creative thinkers and who want to do research and development in the field of high-temperature alloys and their application to new types of power plants. Areas to be investigated include

**HIGH-TEMPERATURE METALS AND REFRACTORY MATERIALS**

**NUCLEAR REACTOR MATERIALS**

**HIGH-TEMPERATURE BEARING AND FRICTION MATERIALS**

Clevite Research develops new principles and new products for other units of Clevite Corp. It is a young organization where good work is quickly recognized. Your professional growth will be accelerated by your associations with men from other fields such as physics, electronics, mechanics, chemistry.

**Address:**

**E. A. Gentry, Personnel Manager**
**CLEVITE RESEARCH CENTER**
**540 East 105th St.**
**Cleveland 8, Ohio**

---

SENIOR

## ENGINEER

**Ph.D. in Chemistry, Physics, or Metallurgy**

*For Materials Research and Radiation Studies Group of the Aircraft Nuclear Propulsion Dept.*

A highly responsible position on an important and interesting project . . . the application of nuclear power for flight. This work involves analysis and co-ordination of all data relative to the effect of radiation on materials.

It requires an active interest in the structure of materials and in the reasons for observed radiation effects, plus 8 to 10 years' experience in the study of the effect of neutrons and gamma radiation on materials.

*Publication of Research Results in the Appropriate Classified or Open Literature is Encouraged.*

**Positions Open in Cincinnati, Ohio and Idaho Falls, Idaho**

*Write to:*

**MR. W. J. KELLY, G.E. CO.**
**P. O. Box 132, Cincinnati 15, Ohio**
**MR. L. A. MUNTHER, G.E. CO.**
**P. O. Box 535, Idaho Falls, Idaho**

**Aircraft Nuclear Propulsion Dept.**

**GENERAL ELECTRIC**

---

**METALLURGIST**

Excellent opportunity in Canadian plant of large cutting tool manufacturer. Knowledge of high speed steel treatment and application desirable. Send resume to:

**Box 1-95, Metals Review**

---

**METALLURGIST**

Must have magnesium or aluminum experience. Majority of time will be spent on production problems which will consist of improving the procedure on established jobs and the rigging of new work. Remainder of time will be spent on development and research.

Mr. J. S. Wickham
**WELLMAN BRONZE & ALUMINUM CO.**
**2525 East 93 St. Cleveland 4, Ohio**

---

**METALLURGIST—SALES**

As a young, progressive metallurgical company, we are interested in adding to our staff a young technical man who is decidedly sales minded and prepared to travel. A college degree is not required but formal academic training in metallurgy or chemical field is virtually essential. Salary open. Please submit comprehensive resume including salary requirements to:

**Box 1-100, Metals Review**

---

**SALES POSITION**

Available for recent graduates with degrees in either metallurgical, chemical or mechanical engineering. Unlimited opportunity with young company producing ferrous and non-ferrous alloys. Territories open in Midwest and on the East Coast

**Box 1-145, Metals Review**

# CHAPTER MEETING CALENDAR

| CHAPTER | DATE | PLACE | SPEAKER | SUBJECT |
|---|---|---|---|---|
| Baltimore | Feb. 20 | Engineers Club | John Smack | Industrial Applications of Ultrasonics |
| Buffalo | Feb. 10 | Mann's 300 Club | Social | Supper Dance |
| Calumet | Feb. 14 | Phil Smidt | Carl Reynolds | Auto Styling |
| Carolinas | Feb. 16 | Winston-Salem | Forum | Joining of Metals |
| Chicago-Western | Feb. 20 | Furniture Mart | M. F. Judkins | High Temperature Steel Applications |
| Cincinnati | Feb. 9 | Eng. Society Hqtrs. | R. D. Thomas | Properties of Modified Type-347 Stainless Steel Weld Metal |
| Cleveland | Feb. 6 | Hotel Hollenden | A. O. Schaefer | National Officers Night |
| Columbia Basin | Feb. | | C. H. Fellows | Research |
| Columbus | Feb. 1 | | R. P. Koehring | Recent Developments in Powder Metallurgy |
| Dayton | Feb. 8 | Engineers Club | E. Hersherde, Jr. | Gems and Their Evaluation |
| Detroit | Feb. 13 | Engineering Society | A. O. Schaefer | Heat Treatment and Metallurgy of Alloy Steel Forgings |
| Eastern New York | Feb. 14 | Panetta's | J. T. Burwell, Jr. | Friction wear and Surface Physics |
| Fort Wayne | Feb. 23 | Hobby House Ranch | Social | Ladies Night |
| Hartford | Feb. 14 | Indian Hill Country Club | F. M. Richmond | Recent Developments in High-Temperature Metallurgy |
| Indianapolis | Feb. 20 | | R. L. Mattson | Residual Stresses in Heat Treatment |
| Jacksonville | Feb. 13 | Bill Graham Co. | R. G. Strother | Modern Methods of Nondestructive Testing |
| Long Island | Feb. 10 | Savoy Plaza | Social | Valentine Party |
| Los Angeles | Feb. 23 | Rodger Young Auditorium | A. Bringewald | Airframe Materials and Manufacturing Research |
| Mahoning Valley | Feb. 11 | Post Room, V.F.W. | Social | Valentine Party |
| Milwaukee | Feb. 21 | City Club | E. N. Skinner | Heat Resisting Alloys for Heat Treating |
| Montreal | Feb. 6 | Queen's Hotel | O. H. Barrett | History, Growth and Expansion of the Ship Building Industry in Canada |
| Muncie | Feb. 14 | Y. M. C. A. New Castle | Panel | Information Please |
| New Jersey | Feb. 20 | Essex House | J. E. King | Cold Extrusion of Steel |
| New Orleans | Feb. 16 | | L. W. Eastwood | Light Alloy Foundry Practices |
| New York | Feb. 10 | Savoy Plaza | Social | Dinner-Dance |
| Northeast Pennsylvania | Feb. 8 | Irem Temple Country Club | A. Gobus | Nondestructive Testing |
| Northwestern Pennsylvania | Feb. 23 | Erie | Plant Visit | Erie Forge and Steel Co. |
| Notre Dame | Feb. 8 | | P. G. Nelson | Deep Drawing of Automobile Steels |
| Oak Ridge | Feb. 15 | K. of C. Hall | A. O. Schaefer | Forged Pressure Vessels |
| Ontario | Feb. 3 | Royal York Hotel, Toronto | S. G. Fletcher | Modern Developments in the Heat Treatment and Production of Tools and Dies |
| Oregon | Feb. 16 | Congress Hotel | | Heat Treating Processes and Equipment |
| Ottawa Valley | Feb. 7 | P.M.R.L. | C. H. F. Cottee | |
| Penn State | Feb. 14 | Mineral Sciences Audit. | A. J. Lena | Precipitation Hardening Stainless Steel |
| Peoria | Feb. 13 | New Amer. Legion Hall | R. I. Severson | Aluminum Bronze |
| Philadelphia | Feb. 24 | | W. D. Manly | Material Problems With Nuclear Reactors |
| Jr. Section | Feb. 13 | Engineer's Club | R. Crowningshield | Enameled Gold Jewelry |
| Phoenix | Feb. 18 | Williams Field Air Force Base | Tour | First Jet Fighter School |
| Pittsburgh | Feb. 9 | | | Carnegie Lecture |
| Puget Sound | Feb. 15 | Engineers Club | | Recent Developments in Heat Treating |
| Purdue | Feb. 21 | Memorial Union | K. Van Horn | Residual Stresses |
| Quebec | Feb. 21 | Laval University | J. S. Fullerton | Some Practical Aspects of Silver Brazing |
| Rhode Island | Feb. 1 | Johnson's Hummock | J. W. Cunningham | Inert Gas Welding of Stainless Steel |
| Rochester | Feb. 3 | Red Men's Club | Social | Bowling Party |
| Rockford | Feb. 22 | Faust Hotel | R. D. Richards | Electric Furnace Brazing |
| Rocky Mountain | Feb. 17 | Oxford Hotel | E. O. Dixon | Better Metal Quality Through Forging |
| Saginaw Valley | Feb. 14 | Fischer's | F. Richardson | Cermets and Ceramics |
| Springfield | Feb. 20 | University of Massachusetts | H. R. Neifert | Relation of Metallurgy to Design |
| Syracuse | Feb. 7 | Onondaga Hotel | D. B. Martin | Powder Metallurgy |
| Texas | Feb. 7 | Ben Milam | V. N. Krivobok | Stainless Steels |
| Tri-City | Feb. 14 | Rock Island Arsenal | R. J. Raudebaugh | Recent Metallurgical Developments |
| Tulsa | Feb. 7 | Alvin Plaza Hotel | K. R. Knoblauch | Instrumentation and Automatic Control Systems in the Metal Processing Industry |
| Warren | Feb. 9 | El Rio | N. J. Culp | Manufacture of Toolsteel |
| Washington | Feb. 13 | Fort Myer Officers Club | A. B. Kinzel | Burgess Memorial Lecture |
| West Michigan | Feb. 20 | Lock's Restaurant | T. H. Spencer | Induction Heat Treating and Brazing |
| Western Ontario | Feb. 10 | Windsor | Stan Cope | Stampings |
| York | Feb. 8 | York | W. T. Rubin | Leaded Steels |

# 300% LONGER GEAR LIFE

with

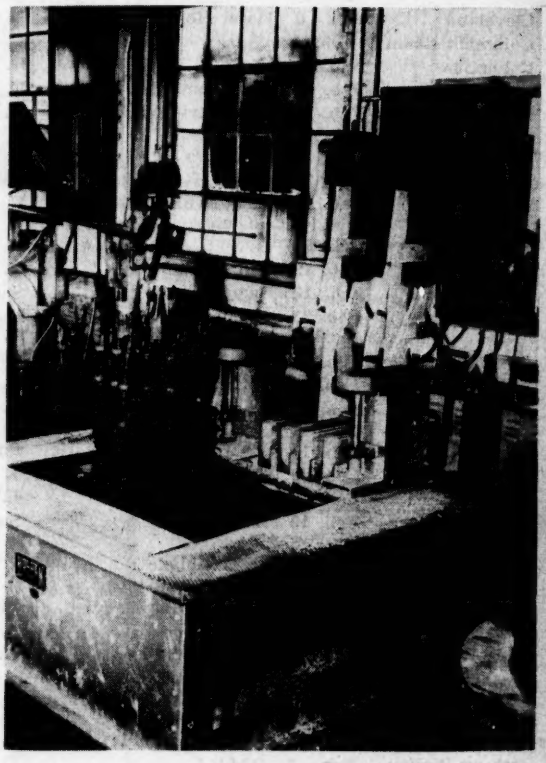
# HOLDEN SALT BATH QUENCHING

A leading farm machinery manufacturer has increased, by 300%, the life of transmission gears by quenching them at 330°F. in HOLDEN Marquench No. 296 Salts.

Gears are quenched directly from adjacent pit carburizing furnaces.

Using a 100 kva HOLDEN Salt Bath Quench Furnace with a compensating constant temperature control blower system, increased life of gears has been obtained without necessitating design change. The gears quench out to a surface hardness of Rockwell C64-65, and have a case microstructure of 100% white needle martensite at the surface.

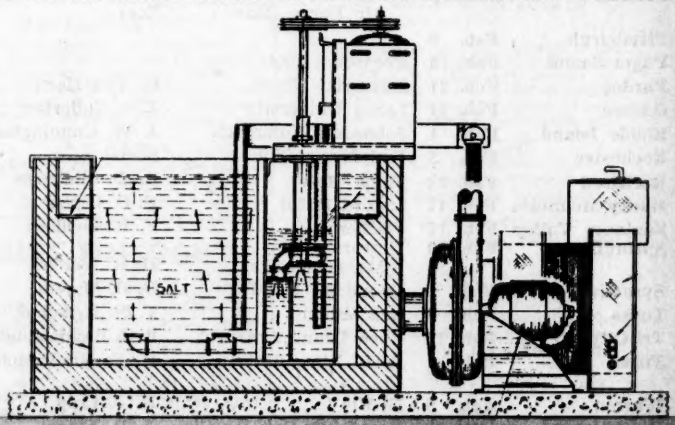
This kind of proved, sure effectiveness is characteristic of HOLDEN specialized quenching salts and equipment. It will pay you to contact our engineers for complete case history and operating data.



This HOLDEN Type 401 Furnace is located between two pit-type carburizing furnaces. 500-750 lbs. are quenched directly from the pit carburizer into the molten salt with a velocity flow of 450 gallons per minute.

1. Automatic Salt Filtration.
2. Positive direction flow.
3. 150 Gallons per minute per pump.
4. Let us process test work for you at Detroit, Michigan and Los Angeles, California.

(New)
Write for following bulletins:
No. 200 Holden Salt Baths
No. 201 Holden Pot Furnaces
No. 204 Pressure Nitriding Process
No. 205 Industrial Furnaces—Gas or Electric
No. 206 Austempering-Martempering
No. 207 Luminous Wall Firing




## THE A. F. HOLDEN COMPANY

Three F.O.B. Points—Los Angeles, Detroit and New Haven

P. O. Box 1898
New Haven 8, Conn.

14341 Schaefer Highway
Detroit 27, Michigan

4700 East 48th St.
Los Angeles 58, Calif.